

Concepts in
**Dental Public
Health**

Second Edition

Jill Mason



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CONCEPTS IN

Dental Public Health SECOND EDITION

CONCEPTS IN **Dental Public Health**

SECOND EDITION

Jill Mason, MPH, RDH

Associate Professor

Oregon Health & Science University

School of Dentistry

Portland, Oregon



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Preface

You are about to venture into an aspect of the oral health professions that may be a new realm to you—one not previously considered as a career possibility. Enter with an open mind, and you can find rewards also not previously considered. Did you enter the profession because you “want to work with people” or “want to help people?” Here is the opportunity to explore new avenues for that personal goal.

This textbook provides an overview of dental public health in greater depth and breadth than the traditional view of community dental hygiene. It builds a foundation in community education and health promotion, but expands to provide a broader view of the core principles and competencies expected at all levels of involvement in public health practice, from part-time volunteer work to a professional career in public health practice.

As depicted on the cover of the text, dental public health involves many entities coming together around a central focus—improving the public’s oral health. When each piece of the puzzle is interconnected, the infrastructure is strong and the benefit to the public is enhanced. This theme is carried throughout the text and each chapter heading depicts pieces of the puzzle addressed in that chapter.

Each chapter is written by a leader in the dental public health community. All have advanced education and expertise in public health. Although primarily written for the dental hygiene student, it is useful for all oral health care providers working in public health settings.

The modular format of the text is specifically designed to allow for flexibility in depth of content or order of presentation for different curricula and teaching styles. Each module centers on a core content area of public health. To accommodate different curricula, the modules can be used in a different sequence than presented. The text also can be used for multiple courses, in the event that public health content is presented in various courses (e.g., statistics, ethics, research, health education, and community dental hygiene).

Key terms are listed at the beginning of each chapter to guide the learner’s study of core concepts. The key terms are often used in public health practice and appear on National Board Examinations. The competencies addressed in each chapter, and listed in Appendix 3, are from the American Dental Education Association’s Competencies for Entry into the Profession of Dental Hygiene. These competencies are not used verbatim in all dental hygiene programs for purposes of accreditation; however, they are the guiding principles for assuring that students are competent for practice and, therefore, remain a useful tool to guide the learner’s study and aid the instructor’s efforts toward that end. Various learning activities are provided for groups or individuals to use inside or outside the classroom. In addition, review questions and answers are provided to reinforce main ideas. Resources, including web sites and search terms, are listed for use with the learning activities, or for more in-depth study and reference. Highlighted at the beginning of each chapter are the stages in the Dental Hygiene Process of Care that are addressed in that chapter as they relate to public health practice.

Module 1: Introduction to Dental Public Health. This module is an introduction to the core principles of public health, with a brief, historical overview of dental public health. This module also highlights more recent trends and the many career opportunities in public health, together with a global perspective of public health from various countries.

Module 2: Program Planning and Evaluation. This module is a primer of public health program planning and evaluation. The module takes the familiar framework of assessment, diagnosis, planning, implementation, evaluation, and documentation and expands it from the patient care setting to its application in public health settings.

Module 3: Health Promotion and Oral Health Education. This module describes the necessary elements of health promotion and health education programs and model programs. In addition, the module provides resources and instruction for creating culturally appropriate materials for use with public programs.

Module 4: Epidemiology and Research. This module provides an overview of epidemiologic and research principles, both for evaluating public programs and for critically reviewing the scientific literature. It also describes the various forms of scientific communication and includes instruction on how to prepare a written article, an oral presentation, and a poster session or table clinic. The chapter on biostatistics uses specific dental examples and progresses from the fundamental concepts of statistical terminology and central tendency to more advanced concepts, such as logistic regression. Sections of the chapter can be selected for study to meet the needs and depth of the individual program curriculum.

Module 5: Ethics and the Law in Public Health Practice. Most ethics texts focus on individual ethics and private practice implications. This module includes basic ethical concepts and terminology and the process of how laws are developed. In addition, it expands the principles and provides examples in the public health arena, to assist advocacy and social justice efforts for populations.

Module 6: National Board Preparation. This module presents a personalized system and checklist to prepare for the Community Dental Hygiene section of the National Board Dental Hygiene Examination (NBDHE). The module includes sample questions in the testlet format of the NBDHE.

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To the contributors, whose perseverance, dedication, and suggestions enhanced the outcome, thank you. What an amazing group of people to work with!

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RBJ - BFF

Contributors

Editor

Jill Mason, MPH, RDH
Associate Professor
Oregon Health & Science University
School of Dentistry
Portland, OR

Contributors

Gail Aamodt, MS, RDH
Clinical Education Coordinator
Dental Health Science
Pacific University
Hillsboro, OR

Phebe Blitz, MS, RDH
Dental Hygiene Program Director
Mesa Community College
Mesa, AZ

Ann O. Dickinson, MS, RDH
Director, Dental Hygiene Program
Department of Dental Hygiene
Remington College- Nashville Campus
Nashville, Tennessee

Ellen Grabarek, MPH, RDH, CHES, AP
Project Director, Del E. Webb Dental Outreach
Program
Department of Dental Hygiene
Northern Arizona University
Flagstaff, AZ

Denise Muesch Helm, MA, RDH, EdD (Cand)
Associate Dean
College of Health & Human Services
Northern Arizona University
Flagstaff, AZ

Beverly A. Isman, MPH, RDH, ELS
Dental Public Health consultant
Davis, CA

Robert Isman, DDS, MPH
California Department of Health Services
Sacramento, CA

Kathy Phipps, MPH, DrPH, RDH
Dental Public Health Consultant
Morro Bay, CA

Rachel Badovinac Ramoni, DMD, ScD
Acting Director, Dental Public Health Residency
Instructor in Developmental Biology
Harvard School of Dental Medicine
Boston, MA

Kneka P. Smith, MPH, RDH
University of New England
Associate Dean for Planning
Portland, Maine

Pamela Zarkowski, BSDH, MPH, JD
Professor and Academic Vice President
University of Detroit Mercy
Detroit, MI

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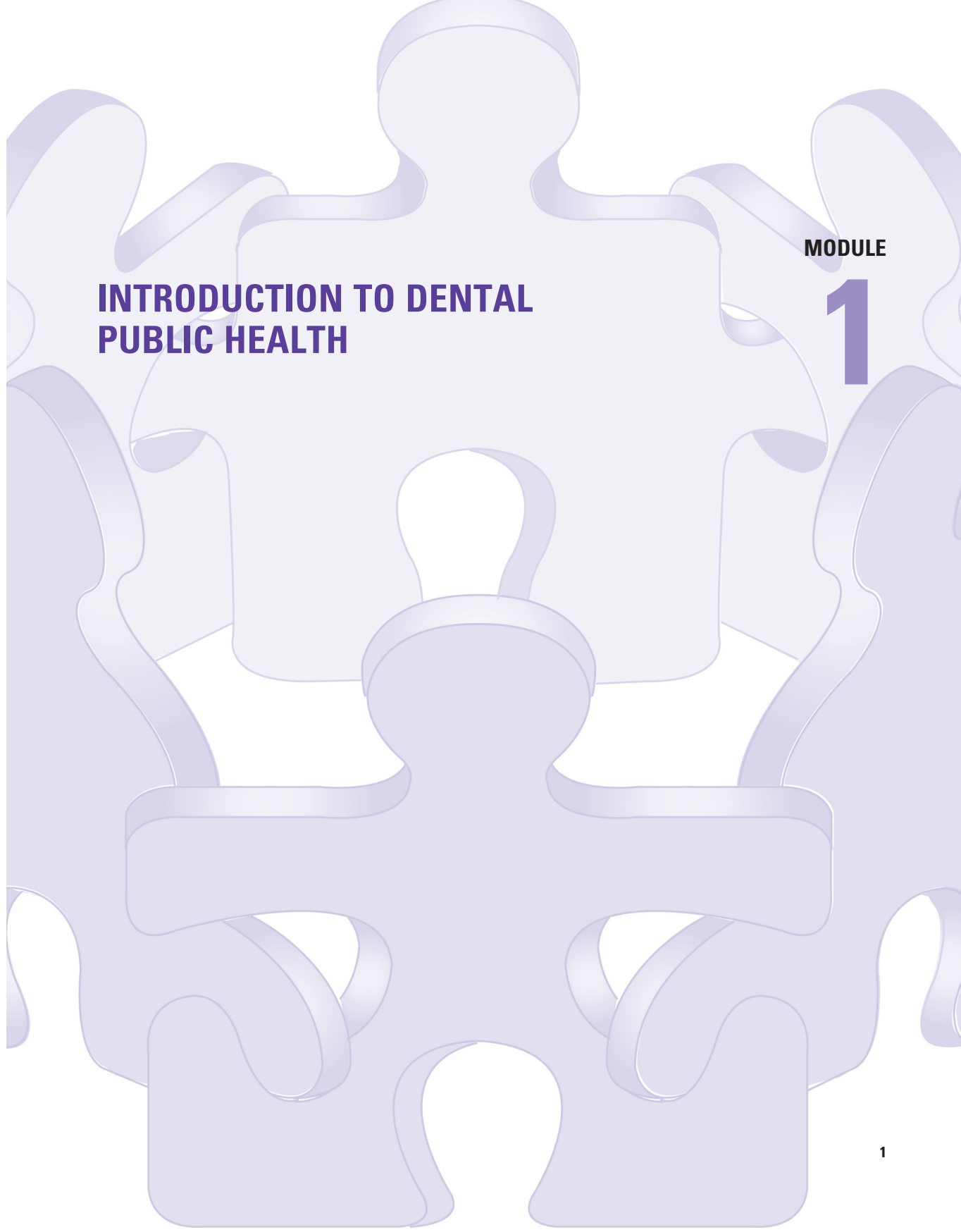
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INTRODUCTION TO DENTAL PUBLIC HEALTH

MODULE

1

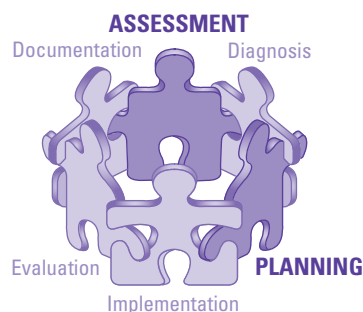
History and Principles of Dental Public Health

1

Objectives

After studying this chapter and completing the study questions and activities, the learner will be able to:

- Define dental public health.
- Define common public health terms.
- Describe three core functions of public health.
- Describe what constitutes a public health problem.
- Describe the four phases in the history of public health.
- Identify key organizations and events that have shaped dental public health.
- Identify federal agencies involved in public health activities.



KEY TERMS

American Association of Public Health Dentistry

American Board of Dental Public Health

American Dental Hygienists' Association

American Public Health Association

Association of State and Territorial Dental Directors

Canadian Association of Public Health Dentistry

Community

Core public health functions

Dental public health Health

Healthy People

Institute of Medicine

Maternal and Child Health

National Center for Health Statistics

National Institute of Dental and Craniofacial Research

Pan American Health Organization

Public health

Social Security Act

Surgeon General's Report on Oral Health

World Health Organization

See Appendix 3 for the ADEA competencies addressed in this chapter.¹

Introduction

As you begin to explore the public health aspects of the oral health profession, you will find both differences and similarities to your clinical experiences. This chapter highlights the history and philosophy of dental public health, the structure of the profession, and the goals of public health. You may find many of your clinical skills in treatment planning, problem solving, and critical thinking are valuable in identifying and solving public health issues in the communities in which you choose to practice. It is the aim of this text to

provide you with the skills and knowledge necessary to be a valuable contributor in the community in which you practice.

It is essential all oral care providers, regardless of practice location and mode, are aware of the unique problems in ensuring oral health for all members of society and participate in the solutions. This text is developed around the philosophy that all members of the oral health professions, and our allies from outside the profession, are all pieces of a puzzle that, when complete, would assure oral health for all members of society. You will also discover that the puzzle is not complete

and there is much opportunity for providers of all types to help shape and complete the puzzle. It may seem that in comparing public health with private practice, they are separate from one another. In fact, they are all pieces of the same puzzle. Although private practice settings treat a significant portion of the population, public health reaches out to many who may not have access to that mode of care. It requires everyone's unique abilities working together to complete the puzzle. As you learn about public health, consider how you, in the type of practice you eventually choose, can help complete the puzzle.

WHAT IS DENTAL PUBLIC HEALTH?

If someone were to ask you about your **health**, how would you respond? Great? Good? Poor? Lousy? Do you think only of your physical status and not your mental mindset? Over time, many people have attempted to define health. Webster defines health as “physical and mental well-being; freedom from disease.”² This is an abbreviated version of the often-used definition established in 1948 by the **World Health Organization** (WHO)³: “health is a state of complete physical, mental, and social well-being and is not merely the absence of disease or infirmity.” How does one know when they have complete physical, mental, and social well-being? What about the multitude of people who live with chronic diseases, such as diabetes or hypertension, and consider themselves healthy? Even given the availability of a definition by a preeminent health organization like WHO, can one definition suffice for all of the nuances and individual perceptions that surround health? Attempting to define health as a dichotomy when it is, in reality, a continuum continues to present difficulties.

A similar difficulty is present when defining **public health**. If health is difficult to define, how does one define public health? A definition presented by Winslow⁴ in 1920 is still used today. He defined public health as “the science and art of preventing disease, prolonging life, and promoting physical health and efficiency through organized **community** efforts.” The

definition does not define what constitutes a healthy public so much as it provides a description of the professional discipline of public health and the method used by that profession to attain or maintain public health. In 1955, J.W. Knutson⁵ also defined the discipline, reflecting the community nature of public health as, “Public health is people’s health. It is concerned with the aggregate health of a group, a community, a state, or a nation.” In 1988, the **Institute of Medicine** (IOM)⁶ defined the mission of public health as “... fulfilling society’s interest in assuring conditions in which people can be healthy.” Interestingly, this last definition includes “society’s interest” as a component in the attainment of the public’s health. As you will encounter throughout this text, the interest, acceptance, and input from recipients of public health interventions are important elements of public health practice.

If we add oral health to our exploration of the definition of health, we next attempt to define dental public health. **Dental public health** is one of nine specialties of dentistry recognized by the American Dental Association. The definition of dental public health adopted by the **American Board of Dental Public Health** (ABDPH), the governing body for the specialty, defines dental public health as:

“The science and art of preventing and controlling dental diseases and promoting dental health through organized community efforts. It is that form of dental practice that serves the community as a patient rather than the individual. It is concerned with dental health education of the public, with applied dental research, and with the administration of group dental care programs, as well as the prevention and control of dental diseases on a community basis.”⁷

The **Canadian Association of Public Health Dentistry** similarly defines public health dentistry:

“Dental public health is concerned with the diagnosis, prevention, and control of dental diseases and the promotion of oral health through organized community efforts. Dental public health serves

the community as the patient rather than the individual, through research, health promotion, education, and group dental care programs.”⁸

These definitions incorporate the concept of the community as the patient, rather than the individual, a key concept of public health that you will encounter throughout this text. The definitions also articulate the importance of public education, research, and program administration to control disease on a community level; however, they may fall short in addressing the impact of societal changes and the role played by various models of health care. In addition, the ABDPH definition was adopted prior to the increased acceptance of the term oral health rather than dental health, whereas the Canadian version uses the term oral health. This terminology has changed, replacing the term dental health with oral health to emphasize more than just teeth in the oral cavity. Professionals recognize that oral cavity health extends beyond dental care of the teeth and supporting structures. Lately, the general public has begun also to make the connection beyond teeth and gums. With oral health now known to be so influential in the general health of the body and vice versa, it is time to incorporate a broader scope for ensuring the public’s oral health. The term oral health also encourages other groups to readily join the effort in improving the public’s oral health when the effort is not so closely aligned with the term dentistry. Unfortunately, dentistry is too often seen as an exclusive profession, keeping a distance from the rest of the health care system. This may be perceived as a barrier for other partners outside the oral health professions who may join in our efforts. Other groups interested in oral health may include other health care provider groups, citizen coalitions, philanthropic organizations, third-party payers, schools, faith organizations, and businesses.

The most distinctive difference between public health practice and private practice is the concept of the community as the patient. In private practice, the patient is the person currently in the dental chair and care is provided based on the individual’s needs and desires. In public health, even in a clinical setting, the care deci-

sions for the person in your chair are impacted by the larger community and the setting in which the person is treated, along with financing mechanisms. Dental public health positions require skills in assessing and diagnosing community oral health needs; planning, implementing, and evaluating community-based oral health programs; providing educational services; applying research; using epidemiology; formulating policy; advocating; and understanding the organization of health care. The specific competencies for community involvement stated in the Competencies for Entry into the Profession of Dental Hygiene (American Dental Education Association [ADEA])¹ and the competencies for dental public health practitioners⁷⁻⁹ express the specific skills needed for practice or employment in dental public health. These will be explored in more detail in Chapter 4. In addition, all of the dental hygienist roles described by the **American Dental Hygienists’ Association** (ADHA)¹⁰ (advocate, educator, clinician, researcher, and administrator/manager) illustrate the close alignment between dental hygiene and public health practice. It should not be overlooked that all dental professionals can and should become involved in community public health efforts. A clear understanding of public health principles is necessary for all oral health practitioners to meet this challenge. It is the ethical responsibility of all health care practitioners to work toward improvement of the health of the community, especially for those who have limited access to care or cannot advocate for themselves.

CORE PUBLIC HEALTH PRINCIPLES

Public health is often an invisible infrastructure until crisis occurs. The public health infrastructure includes all governmental and non-governmental entities that provide any public health services.¹¹ From how many public health measures have you personally benefited? Have you been immunized? Do you drink fluoridated water? What other measures can you think of?

A recent trend in business and government is increased accountability. For example, schools

are expected to be accountable to the public for the educational achievement of their students, businesses must be more accountable to clients and investors, and government entities must be more accountable to the taxpayers who fund their programs. In this era of demand for greater accountability, it is incumbent on schools, businesses, and governments to develop methods to evaluate and ensure quality in their respective endeavors. Dental public health practice is not without guidelines, competencies, goals, and expectations at all levels of practice. Several groups, such as the IOM, the **American Public Health Association**, and the **Association of State and Territorial Dental Directors** (ASTDD), have developed frameworks to assess progress, quality, and success in public health.^{6,12,13} These frameworks work well to elucidate the nature of public health practice.

In 1988, the IOM⁶ delineated the core functions of public health agencies as assessment, policy development, and assurance (Box 1-1). This landmark report prompted the public health community to look closely at services provided and develop a statement of **core public health functions** that are considered essential public health services (Box 1-2).¹²



FIGURE 1-1 The government's role in public health.¹²

All of these important public health functions are interrelated and continuous and based on evidence provided by research to form a strong foundation for public health practice. This interrelationship is illustrated in Figure 1-1 by the diagram developed by the Public Health Functions Steering Committee.¹²



BOX 1-1 The Role of the Government in Public Health—Core Functions of Public Health Agencies

Assessment: Each public health agency regularly and systematically collects, assembles, analyzes, and makes available information on the health of the community, including statistics on health status, community health needs, and epidemiologic and other studies of health problems.

Policy Development: Each public health agency exercises its responsibility to serve the public interest in the development of comprehensive public health policies by promoting use of the scientific knowledge base in decision making and leading in the development of public health policy.

Assurance: Public health agencies assure their constituents that services necessary to achieve agreed upon goals are provided by encouraging actions by other entities, requiring such action through regulation or providing services directly. Each public health agency involves key policy makers and the general public in determining high-priority personal and community-wide health services, which the government guarantees to every member of the community.

From *The Future of Public Health*. Institute of Medicine. National Academy of Sciences, 1988.⁶



BOX 1-2 Essential Public Health Services

What Public Health Does (The Purpose of Public Health):

- Prevents epidemics and the spread of disease
- Protects against environmental hazards
- Prevents injuries
- Promotes and encourages healthy behaviors and mental health
- Responds to disasters and assists communities in recovery
- Assures the quality and accessibility of health services.

How Public Health Serves (The Practice of Public Health) (Essential Services):

- Monitors health status to identify and solve community health problems
- Diagnoses and investigates health problems and hazards in the community
- Informs, educates, and empowers people about health issues
- Mobilizes community partnerships and actions to identify and solve health problems
- Develops policies and plans that support individual and community health efforts
- Enforces laws and regulations that protect health and ensure safety
- Links people to needed personal health services and assures the provision of health care when otherwise unavailable
- Assures a competent public and personal health care workforce
- Evaluates effectiveness, accessibility, and quality of personal and population-based health services
- Researches for new insights and innovative solutions to health problems.

From Public Health in America, Fall 1994. Public Health Functions Steering Committee.¹² Available at: www.health.gov/phfunctions/public.htm. Accessed August 2008.

Following this report of essential public health functions, the ASTDD further developed the list of services as it relates directly to dental public health services provided at the state level (Box 1-3).¹³ These guidelines, used at national, state, and local levels, provide a unified framework for all public health efforts, allowing all public health programs to work toward common goals. The common framework also allows for better collaboration, sharing of information, and documentation of success among public health partners.

DEFINING A PUBLIC HEALTH PROBLEM

After defining the role of public health and the essential services that should be provided, what constitutes a public health problem that warrants resources applied toward its solution? If the

public health workforce responded to all public concerns regarding health, it would result in a reactive, knee-jerk, inefficient, and ineffective response to society's health needs.

The current criteria used to define a public health problem are (i) a condition or situation that is a widespread actual or potential cause of morbidity or mortality, and (ii) a perception on the part of the public, the government, or public health authorities that the condition is a public health problem.¹⁴ This definition allows a broad interpretation of a public health problem in that "widespread," "potential," and "perception" can all be interpreted differently in different situations with different threats to the public. Bioterrorism, West Nile Virus, Severe Acute Respiratory Syndrome (SARS), natural disasters, automobile safety, water purification, and oral



BOX 1-3 Essential State Dental Public Health Services

Assessment

- Assess oral health status and needs
- Analyze determinants of identified needs
- Assess fluoridation status of water systems and other sources of fluorides
- Implement oral health surveillance systems

Policy Development

- Develop plans and policies through a collaborative process
- Provide leadership to address oral health problems
- Mobilize community partnerships

Assurance

- Inform, educate, and empower the public
- Promote and enforce laws
- Link people to oral health services; assure availability, access, and acceptability
- Support primary and secondary prevention programs
- Assure the capacity and expertise of the public and personal health workforce
- Evaluate effectiveness, accessibility, and quality of oral health services
- Conduct research and support demonstration projects

From Guidelines for State and Territorial Oral Health Programs: Essential Public Health Services to Promote Oral Health in the United States (2007 Revision). The Association of State and Territorial Dental Directors. Available at: <http://www.astdd.org>. Accessed January 2009.¹³

disease may be seen as more or less a problem depending on whom you ask. Later chapters will describe methods for identifying public health problems and developing solutions.

HISTORY OF PUBLIC HEALTH

Public health has traversed through three phases into a current, fourth phase that is centered on the current societal needs of the times and the progression of industrialization and technology in the world. During the first phase (1849–1900), public health activities were related to the elimination and control of diseases that grew out of rapid industrialization and crowded and poor living conditions. Many activities were aimed at reducing the morbidity and mortality of such diseases as cholera, polio, and plague. Efforts, therefore, were directed at basic sanitation methods.

In the second phase (1880–1930), population-based prevention strategies were possible with advances in bacteriology and immunizations, reducing the effects of infectious diseases. Immunization programs were an outgrowth of this phase.

Continued advancements in technology in a third phase (1930–1975) allowed a further shift to the treatment of disease through increasingly complex medical treatments. Interventions in this phase occurred increasingly in hospitals rather than with community-based public health measures. During this phase, many major infectious diseases, such as smallpox, were eradicated and cures for many acute health problems were developed.

The current, or fourth, phase arises from the realization that technology may be strikingly effective in the treatment or cure of acute health

problems but ineffective in managing chronic lifestyle diseases and controlling the spiraling cost of high technology health care. The value of technology is limited because of the lack of availability to all members of the public and the inability to correct the most prevalent diseases we now face, those that occur as a result of longer life expectancy gained from earlier phases of public health and lifestyle choices. This current phase now emphasizes a broader approach to health. It goes beyond prevention of specific diseases to encompass the concept of overall wellness. Health promotion strategies are used to encourage healthy lifestyles, resulting in a reduced risk of multiple problems. For example, choosing not to smoke or choosing to stop smoking can reduce the risk for lung cancer, hypertension, periodontal disease, heart disease, or emphysema.

Will terrorist actions, such as the events of September 11, 2001, and natural disasters, like Hurricane Katrina and others, cause us to look again at our public health infrastructure and our ability to respond to new public health threats, such as bioterrorism? Will we enter a new phase of public health? Will we strengthen the protection from and rapid response to unknown or undefined threats to health? The quick responses and measures taken to stop the spread of the SARS epidemic indicate how rapid information transfer and global cooperation can protect the public's health and highlight how important cooperation and information sharing can be in preventing a world disaster. The effectiveness of our response to major disasters teaches us what pieces of the puzzle are missing and what improvements can be made.

HISTORIC HIGHLIGHTS IN DENTAL PUBLIC HEALTH

"Trying to plan for the future without a sense of the past is like trying to plant cut flowers"—

Daniel Boorstin

No text would be complete without setting the stage for what is to come by exploring the path by which we have traveled. Knowing where we have been helps us understand where we are

and where we are going. Several key events have shaped the profession of dental public health to make it what it is today.

The dental hygiene profession originated in 1906 as Dr. Alfred C. Fones began a course of study for his assistant, Irene Newman.¹⁵ This early profession was centered in public health practice. The dental hygienist was prepared to provide education and treatment in the community setting and to work as an advocate for dental care. The preventive nature of the dental hygiene profession is still a perfect fit in the public health arena as envisioned by Alfred Fones. Even today, the mission of the ADHA is "to improve the public's total health."¹⁶

Public health continues to be an arena in which oral health professionals work together and with other groups to improve the oral health of the communities in which they work and live. It is sad to think that the original purpose of the dental hygiene profession has blurred because of the fear that dental hygienists may be a threat to dental practices and the public. This perception has resulted in limitations put on dental hygiene licensure and practice through restrictive dental practice acts, which are only now starting to reverse, with more states allowing dental hygienists to practice in other than private settings and under less restrictive supervision requirements. State dental practice acts are also evolving to allow dental hygienists to perform services not permitted in the past. However, it will be some time before Fones' vision is truly fulfilled.

A key public health event occurred in August 1935. The **Social Security Act**,¹⁷ passed by Congress, established unemployment compensation and benefits for the elderly. In addition, it provided aid to the individual states for health and welfare activities, including grants for **Maternal and Child Health** (MCH). Because oral health services were included in maternal and child health block grants, many states established dental public health units within their health department structure. The number of dental public health units grew so rapidly that, in 1937, a group of state dental administrators founded the American Association of Public Health Dentists (AAPHD), which was changed

in 1983 to the **American Association of Public Health Dentistry**, reflecting the expanded membership that included dental hygienists, health educators, and others. In 1977, the AAPHD voted to allow dental hygienists to be voting members of the organization, becoming the first and only sponsoring organization of a dental specialty to allow full membership to dental hygienists.¹⁸

The 1940s saw many dental public health developments. During World War II (WWII), the dental services of the armed forces expanded considerably. This was a direct result of the poor oral health status of the young recruits being inducted, which shed light on the extensive dental needs of the United States population.¹⁹ Dental services for the armed forces increased during WWII because of selective service rejections, resulting from about 10% of potential recruits failing the military physical examination. The recruits lacked the necessary six opposing teeth in each arch to meet the military standard.¹⁹ To accommodate the manpower needs for the war, selective service requirements were again lowered twice before the end of the war. The growth in armed forces dental services and the need to treat large groups of people efficiently and effectively became the seed for the concept of the community as the patient, which has remained a core concept for dental public health practice. The armed forces experience led to the development in 1948 of the National Institute of Dental Research (NIDR) to address the national dental problem.¹⁹ The NIDR was eventually changed to the **National Institute of Dental and Craniofacial Research** (NIDCR), reflecting a broader perspective about oral growth and development.

In 1945, controlled clinical trials of water fluoridation began in Grand Rapids, Michigan, and Newburgh, New York. These trials forever changed the smiles of America and led to the establishment of water fluoridation as a safe, effective means of preventing dental caries. Indeed, water fluoridation, considered one of ten great public health achievements of the 20th century,²⁰ is supported by all major health professional organizations (Box 1-4).



BOX 1-4 Ten Great Public Health Achievements of the 20th Century

- Vaccination
- Motor vehicle safety
- Workplace safety
- Infectious disease control
- Reduction in death from coronary heart disease and stroke
- Safer and healthier food
- Healthier mothers and babies
- Family planning
- Fluoridated drinking water
- Recognition of tobacco use as a health hazard

From Ten Great Public Health Achievements—United States, 1900–1999. Centers for Disease Control and Prevention. MMWR 1999;48(12):241–243.²⁰

In 1951, public health dentistry was recognized as the seventh of what are currently nine specialties in dentistry. The ADHA also is developing special emphases in dental hygiene practice, one of which would be public health. This is evidenced by the ADHA 2008 adoption of the Competencies for the Advanced Dental Hygiene Practitioner.²¹ This new practitioner is expected to provide a wide range of services in public health, becoming another piece of the public health framework.

In January 2000, the Department of Health and Human Services launched **Healthy People 2010**, a comprehensive, nationwide health promotion and disease prevention plan.²² It builds on similar documents of 1990 and 2000 and contains 467 objectives designed to be a framework for improving the health of the nation during the first decade of the 21st century. There are 28 focus areas, each representing a public health area, including oral health. The objectives serve as targets for the health of the nation for the year 2010 and provide a basis for comparison and a focus for health agencies at all levels to

participate in the goals of the nation. Tracking of progress is the responsibility of the **National Center for Health Statistics**, which provides a centralized location for information and data related to the objectives. Healthy People 2020 is the next step in the process and is planned for release in 2010.

The **Surgeon General's Report on Oral Health** was released in May 2000.²³ This was the first Surgeon General's Report on Oral Health in the more than 50-year history of Surgeon General Reports. The report highlights the fact that oral health is better now than ever before in history. The report's primary message is that oral health is essential to the general health and well-being of all Americans and that it can be achieved by all Americans. However, the report also illustrates the profound disparities that exist in oral health in America—children, the elderly, members of racial and ethnic groups, and those with disabilities and complex health conditions are at greater risk for oral disease. The report calls for a national partnership to provide opportunities for individuals, communities, and the health professionals to work together to maintain and improve the nation's oral health. It is too early to know the full impact of this report on oral health in America; however, public health dentistry professionals are taking the charge seriously.

PUBLIC HEALTH INFRASTRUCTURE

The fabric of the public health infrastructure in the United States is an example of a broad, sweeping network of many entities, working at all levels of government and society to protect the health of Americans. A constant challenge in public health is that efforts are occurring on so many fronts that coordination and collaboration are often difficult. However, the Internet and common goals and frameworks allow for better communication and easier access to information. This network is often invisible to the beneficiaries of the efforts; however, all of these protections and core functions of a public health infrastructure are part of our everyday lives.

The dental public health network also appears at all levels of society. Many local, national, and international governmental agencies include a dental public health component and opportunities for dental public health careers. Chapter 4 highlights many of these career opportunities in greater detail.

The United States Government will be used here to illustrate a public health and dental public health infrastructure. In the United States, the President's Cabinet includes leading officials of the fifteen executive departments of the government. Within these departments are many agencies responsible for essential services in public health. Figure 1-2 highlights the departments and agencies with significant dental public health functions. Many of these agencies work together and in tandem with schools, community organizations, philanthropic organizations, and others to accomplish their goals. Similar infrastructures also occur at local, state, provincial, and international levels.

Global health also affects the health of the local population. With the increased ability to travel throughout the world, health concerns can quickly transfer from one country or area of the world to another and become a global public health problem. Infectious and life-threatening diseases, such as SARS and HIV/AIDS, are a leading concern. The effect of global movement of people from one country to another also affects the need for a strong oral health infrastructure. Therefore, it behooves public health professionals and agencies from various countries to work together to solve problems, eradicate disease, and protect people from newly developing threats. Certain, more notable, global entities involved in public health endeavors are the WHO and the **Pan American Health Organization (PAHO)**.

The WHO headquarters is located in Geneva, Switzerland. Their objective is attainment of the highest possible level of health by all peoples.²⁴ WHO acts as the directing and coordinating authority on international health work and proposes regulations and makes recommendations about global public health practices. The World Oral Health Report 2003 states that oral diseases

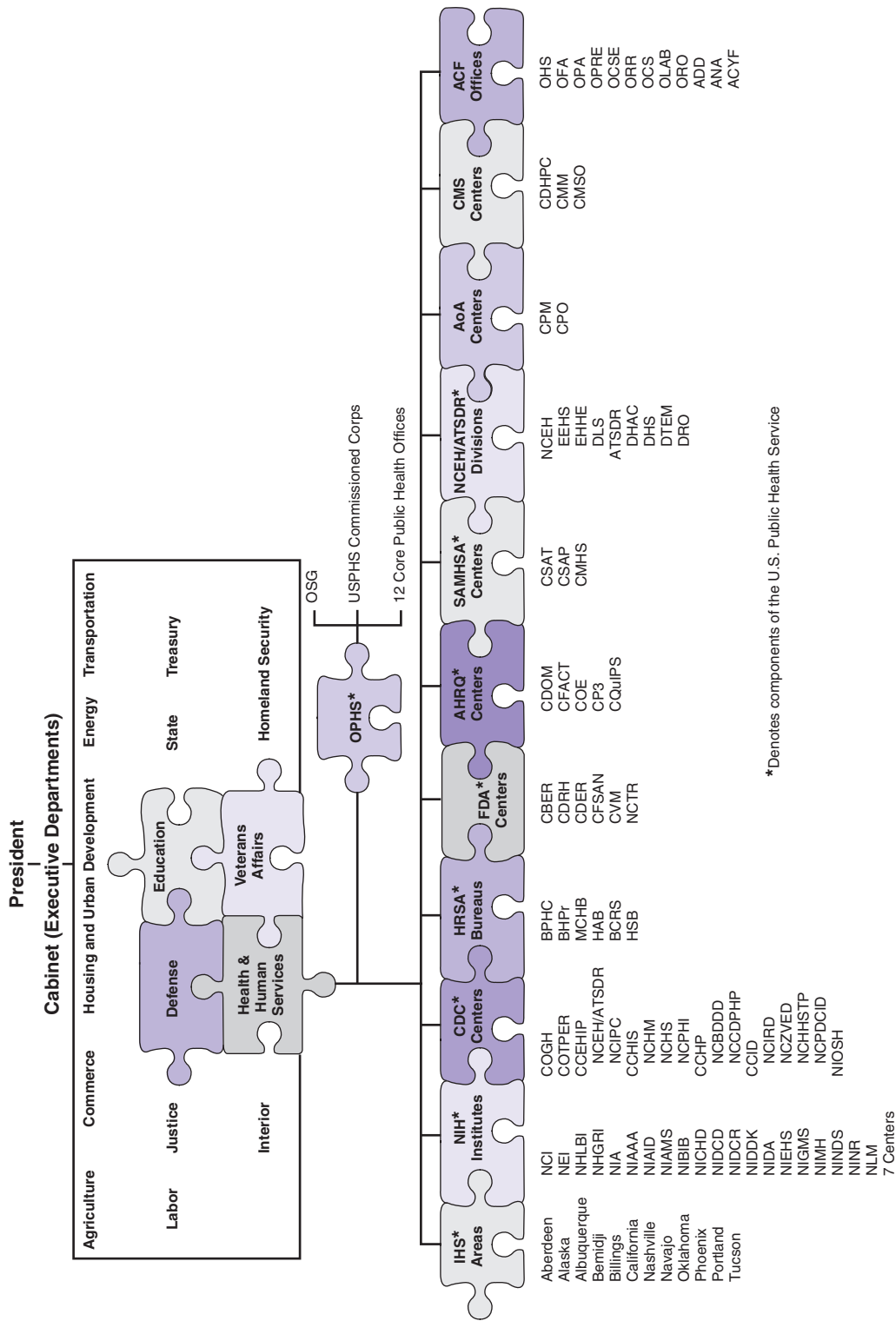


FIGURE 1-2 United States—Federal Infrastructure of Health Services. (See Appendix 2 for a listing of the acronyms and their meanings).

are a major public health problem and that increased emphasis should be on developing global policies in oral health promotion and oral disease prevention.²⁵ One priority is more effective coordination with other WHO programs and external partners.

The PAHO headquarters is located in Washington, DC. It is an international public health agency, founded in 1902, that includes all 35 countries in the Americas.²⁶ Its mission is to strengthen national and local health systems and to improve the health of the peoples of the Americas. PAHO collaborates with such entities as Ministries of Health, governmental agencies, nongovernmental organizations (NGOs), universities, social security agencies, and community groups.

Summary

Much of public health, which has evolved with time, is an invisible infrastructure that has been developed to protect the health of the public. Public health activities occur at all levels of government and society and include efforts to improve the public's oral health. Core functions of public health entities and competencies for public health professionals guide public health practice. The dental public health profession has a rich history of working to improve the oral health of the public. In addition, the mission of the dental hygiene profession and the professional roles of dental hygienists are a reflection of the natural fit between dental hygiene and public health, which was envisioned by Dr. Alfred Fones as he prepared the first dental hygienist.

Learning Activities

1. List public health services from which you have personally benefited.
2. Develop your own definition of dental public health.
3. Choose a governmental agency with oral health responsibilities and write a description

of its mission, activities, budget, and role in the dental public health infrastructure.

4. Write a reflection paper discussing what constitutes good oral health.
5. Choose a particular oral health problem in your community and create a list of organizations or community groups in your community that would be important partners in an oral health coalition formed to address the problem (e.g., early childhood caries, fluoridation of the community's water supply, school fluoride rinse program).
6. Write a reflection paper on the pros and cons of the public health infrastructure being "invisible."
7. Identify a public health problem and describe why it constitutes a public health problem.
8. Choose a state, province, or a country other than the United States and investigate the dental public health infrastructure of the chosen area.
9. Create a classroom game based on the ability to link an acronym with a public agency and the role it has in public health. Include the agency's mission and location and other details.

Resources

- American Association of Public Health Dentistry (AAPHD) (listserve): <http://www.aaphd.org>
 American Public Health Association Oral Health Section: <http://www.apha-oh.org>
 Association of State and Territorial Dental Directors.: <http://www.astdd.org>
 World Health Organization: <http://www.who.int/en/>
 Pan American Health Organization.: <http://new.paho.org/hq/index.php?lang=en>
 U.S. Government official Web portal: <http://www.usa.gov>
 Healthy People 2020: <http://www.healthypeople.gov/HP2020>
 American Dental Hygienists' Association: <http://adha.org>
 Canadian Association of Public Health Dentistry: <http://www.caphd-acsd.org>

Review Questions

1. The third phase of public health included all of the following EXCEPT the:
 - a. treatment of disease with complex medical treatment.
 - b. eradication of smallpox.
 - c. intervention through hospitalization rather than the community.
 - d. cure for acute health problems.
 - e. effective management of chronic, lifestyle-related diseases.
2. State dental public health units originally developed as a result of the:
 - a. establishment of the American Association of Public Health Dentistry.
 - b. need for recruits during WWII.
 - c. Surgeon General's Report.
 - d. Maternal and Child Health grants to states.
 - e. creation of the NIDR.
3. The controlled clinical trials of water fluoridation began in:
 - a. 1937.
 - b. 1942.
 - c. 1945.
 - d. 1948.
 - e. 1953.
4. The primary reason for developing the NIDR was to:
 - a. provide a central agency to monitor state fluoridation efforts.
 - b. address the national dental problems discovered through selective service rejections.
 - c. create educational opportunities for dental public health professionals.
 - d. make dentistry more visible at the National Institutes of Health.
 - e. study the cost-effectiveness of community water fluoridation.
5. Core functions of public health include:
 - a. assessment.
 - b. policy development.
 - c. assurance.
 - d. funding of oral health programs.
 - e. a, b, and c.

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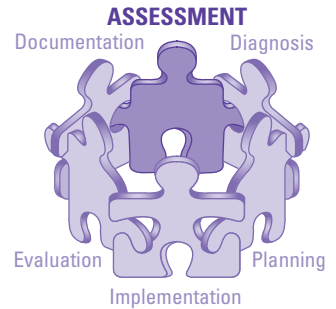
Trends in Dental Public Health

2

Objectives

After studying this chapter and completing the study questions and activities, the learner will be able to:

- Discuss the reasons for oral health disparities and the lack of access to care.
- Describe at least five public health strategies for reducing oral health disparities and access problems.
- Discuss trends in financing for oral care and community-based public health programs.
- Describe potential reasons for a fragile dental public health infrastructure and current efforts to address the problems.
- Discuss challenges posed by ethnic and cultural discrepancies between the oral health workforce and the general population.
- Give examples of multidisciplinary collaborations and public–private partnerships to address oral health problems.
- Give examples of ways to integrate oral health with general health and public health.
- Discuss how advances in science and information technology influence the field of dental public health.
- Discuss a variety of health communication strategies.
- Discuss the goal of evidence-based practice and obstacles to implementing this approach in public health settings.



KEY TERMS

Anticipatory guidance

Capitation

**Children's Health Insurance
Program**

Community coalitions

**Community-based participatory
research**

Culturally relevant

**Dental Health Professional
Shortage Areas**

Dental home

Diffusion of innovations

Evidence-based practice

Gatekeeper

Health communication

**Integration of oral health and
general health**

Interdisciplinary

Leadership development

Literacy

Loan forgiveness program

Managed care plans

Media advocacy

Medicaid

Medicare

**Mobile and portable dental
services**

Oral health disparities

Patient navigators

Plain language

**Public health care financing
programs**

Risk assessment

Safety net dental clinics

Social marketing theory

Systematic reviews

Teledentistry

Volunteerism

See Appendix 3 for the ADEA competencies addressed in this chapter.¹

Introduction

“It was the best of times, it was the worst of times; it was the age of wisdom, it was the age of foolishness; it was the epoch of belief, it was the epoch of incredulity; it was the season of Light, it was the season of Darkness; it was the spring of hope, it was the winter of despair; we had everything before us, we had nothing before us . . .”

Charles Dickens (1812–1870)

This quotation from *A Tale of Two Cities* by Charles Dickens captures the seemingly opposing perspectives that have characterized the field of dental public health for the last few decades. It reflects the vicissitudes of public health, as well as the importance of considering different perspectives on an issue. Students who learn ideal public health practices while in school often do not realize how much the fields of public health and dental public health fluctuate in response to overall societal, medical, economic, and political changes. Traditional approaches that have been previously successful may no longer be relevant. Dental professionals must be aware of trends that affect the public’s oral health and the way that professional care is delivered and financed.

Public health professionals who stay energized by new challenges that arise on a daily basis may also be frustrated by ongoing budget fluctuations and bureaucratic processes that appear to be inflexible and outdated. One day may be highlighted by a successful fluoridation campaign and the next by a request to cut 20% from the oral health program budget due to an overall budget deficit. Dental public health professionals face an environment, therefore, in which they need to be flexible, proactive, up-to-date, creative, and compassionate. Those who succeed have learned the importance of maintaining a sense of balance—between a career and personal/family interests, idealism and reality, personal integrity and compromise, and innovation and patience. This chapter addresses certain trends in the United States that challenge dental public health practice and certain ways that organizations, communities, and professionals are meeting these challenges.

ORAL HEALTH DISPARITIES

Although oral health problems affect everyone, certain population subgroups, defined by demographic factors such as age, sex, race or ethnicity, socioeconomic status, primary language, geography, medical or disability status, and behavioral lifestyles, experience higher levels of oral disease. They are said to have **oral health disparities** in comparison with other groups. Non-Hispanic Blacks, Hispanics, American Indians, and Alaska Natives generally have the poorest oral health of the racial and ethnic groups in the United States.² Limited knowledge of and access to preventive oral health measures and professional care have contributed to these disparities. Box 2-1 summarizes some statistics to highlight the extent of the problem.³⁻⁷

The U.S. population is aging, with the fastest growing segment ages 85 years and older. The first baby boomers will turn 65 in 2011. By 2030, about 71 million Americans will be ages 65 and older (about 20% of the population).⁸ There are pronounced geographic shifts in the U.S. population as well, with southern and western states increasing in population. Most older persons remain in the community; in 2000, 4.5% of people ages 75 to 84 and 18.2% of those 85 and older lived in nursing homes.⁹ Many more reside in assisted living facilities and on their own or with relatives. The number of persons with disabilities living in the community, regardless of age, continues to increase. Older Americans use more health services than previous generations. With improved oral care, these groups retain their teeth longer, increasing the demand for comprehensive services that can be provided in different settings. This presents a challenge to planners, academic faculty, and clinicians, especially as geriatric dentistry or special care dentistry are not yet one of the accredited dental specialties.

More than one of four Americans is Black, Hispanic, or Asian/other non-Hispanic; this proportion will increase to one of three Americans by 2020.² More than one in 10 U.S. residents is foreign-born, the majority of whom are Hispanic or Asian/Pacific Islander origin. Many arrive in



BOX 2-1 Oral Health Needs and Disparities

- Dental caries is the most common chronic childhood disease—five times more common than asthma and seven times more common than hay fever.
- Poor children suffer twice as much dental decay as their more affluent peers and the disease is more likely to be untreated; this trend continues into adolescence.
- Between 1988–1994 and 1999–2004, tooth decay in primary teeth of children ages 2 to 5 years increased from 24% to 28% and untreated dental decay also increased.³
- American Indian/Alaska Native children ages 2 to 4 years have five times the rate of dental decay of all U.S. children.
- Between 1988–1994 and 1999–2004, the use of dental sealants increased from 22% to 30% among youths and from 18% to 38% among adolescents.³
- Uninsured children are 2.5 times less likely than insured children to receive dental care. For each child without medical insurance, there are at least 2.6 children without dental insurance.
- According to the 2004 Medical Expenditure Panel Survey, high-income children under age 21 were twice as likely to have a visit as poor children, and the percentage of children with no dental coverage decreased from 1996 to 2004.⁵
- More than two out of every three children with Medicaid coverage did not receive any dental services in Federal Fiscal Year 2006.⁶
- More than 51 million school hours are lost each year to dental-related illness; poor children suffer nearly 12 times more restricted activity days than higher-income children.
- A greater percentage of non-Hispanic Blacks ages 18 years and older have missing teeth compared with non-Hispanic Whites.
- American Indian/Alaska Native populations have much greater rates of dental caries and periodontal disease in all age groups than the general U.S. population. The high prevalence of diabetes is a contributing factor.
- Oral cancer accounts for a greater percentage of cases of cancer than ovarian, cervical, thyroid, or brain cancer.⁷
- Of all oral cancer cases, 85% were among whites, 10% among blacks, and almost 5% among Hispanics.⁷
- The 5- and 10-year relative survival rates for all stages of oral cancer are 59% and 44%, respectively.⁷
- African American males have the highest incidence of oral and pharyngeal cancers in the United States and their 5-year survival rates are lower than the rest of the population.
- Small-scale studies show that populations with mental retardation or other developmental disabilities have higher rates of poor oral hygiene and have periodontal treatment needs greater than the general population.
- Almost two thirds of community residential facilities for persons with disabilities report inadequate access to dental care for their residents.
- Sixty-five percent of child abuse cases involve head and oral–facial trauma.
- Oral clefts are more common among North American Indians (3.7 per 1,000 live births) and more common among Whites than Blacks (1.7 versus 0.5 per 1,000 live births).

From Oral Health in America: A Report of the Surgeon General. Rockville, MD: DHHS, NIDCR, NIH, 2000,⁴ except where indicated otherwise, with permission.

the United States with significant unmet oral health needs, inadequate finances, and a limited knowledge of the English language. When seeking care, they find themselves in a cultural and communication disconnect with a predominantly White and English-speaking dental and dental hygiene workforce and with limited resources to pay for care. They may not receive timely care or any care and are more likely to have negative health encounters.

In 2000, 45% of the adult U.S. population read at an eighth grade level or lower. About 45% of English-speaking adults are estimated to have limited **literacy** skills that interfere with their ability to handle basic skills involved in seeking and receiving health care.¹⁰ Health literacy is important for learning oral health knowledge, completing health applications and forms, following health recommendations, purchasing oral health care products, promoting oral health to others, communicating with oral health care providers, and navigating various aspects of an oral health care system.

What is being done nationally to track and address these disparities?

1. Healthy People is a national health promotion and disease prevention initiative that includes the goal of eliminating health disparities among different segments of the population. Oral Health, with 17 objectives, is a separate focus area in the Healthy People 2010 objectives, but is also woven into many other focus areas, such as maternal and child health, cancer, diabetes, access, and infrastructure.¹¹
2. In April 2003, the Surgeon General issued A National Call to Action, a framework for oral health action and strategies for collaboration to reduce disparities and improve oral health.¹² The report calls for action on the part of individuals and groups in five areas: change perceptions of oral health; overcome barriers by replicating effective programs and proven efforts; build the science base and accelerate science transfer; increase oral health workforce diversity, capacity, and flexibility; and increase collaboration. National organizations as well as state and local oral health coalitions

are using this framework to develop strategic plans and implement activities.

3. Lack of comparable or updated data at state and local levels hinders attempts to document improvements in oral health, despite continuing efforts to refine data collection and analysis for oral health indicators. The National Oral Health Surveillance System (NOHSS), developed jointly by the Association of State and Territorial Dental Directors (ASTDD) and the Centers for Disease Control and Prevention (CDC), is one attempt to collect and analyze comparable data. On the NOHSS web site, data for the following eight oral health indicators can be displayed in tables, graphs, and maps for the nation and each state that submitted data: (i) dental visits, (ii) teeth cleaning, (iii) complete tooth loss, (iv) fluoridation status, (v) dental caries experience, (vi) untreated dental caries, (vii) dental sealants, and (viii) cancer of the oral cavity and pharynx. Other indicators are under consideration. These data can be used to advocate for more resources to address oral health disparities and to track improvements in oral health. More information on the NOHSS is included in subsequent chapters.
4. State and local health departments, dental schools, and dental hygiene programs can play a role in reducing oral health disparities by conducting research using measures that yield comparable data. To increase resources as part of its Plan to Eliminate Craniofacial, Oral, and Dental Health Disparities, the National Institute of Dental and Craniofacial Research (NIDCR) has funded two cycles of grants for Centers for Research to Reduce Oral Health Disparities to encourage **interdisciplinary** research across components of academic health centers and with community-based agencies and organizations.² The focus is on **community-based participatory research** where the community is an equal partner in identifying research priorities and in all phases of the projects. Also as part of the Disparities Plan, NIDCR and CDC collaborated on the formation of the Dental, Oral, and Craniofacial

Data Resource Center to consolidate health and disease data from multiple sources. CDC also funds a network of Prevention Research Centers across the country, some of which are conducting interdisciplinary oral health research.

FINANCING OF PUBLIC HEALTH AND ORAL HEALTH CARE

Unlike medical care, a large portion of oral health care is financed privately, either as out-of-pocket payments made directly to a dentist or through employment-based dental insurance benefits. Since 1960, these two sources have financed more than 93% of all dental expenditures. Nationally, the public paid out-of-pocket for 44% of dental expenditures, but for only 15% of all personal health care expenditures (including dental) in 2006.¹³

The two largest **public health care financing programs** are **Medicare** and **Medicaid**. In 2007, the Medicare program provided health insurance coverage for more than 44 million people who were ages 65 and older, certain people with disabilities, and persons with kidney failure.¹⁴ Since its inception in 1965, with a few minor exceptions, Medicare has never provided coverage for oral health services.

Medicaid is a jointly funded, federal–state health insurance program for certain low-income and needy people. It covers approximately 42.1 million individuals, including children, seniors, people who are blind or have other disabilities, and people who are eligible to receive federally assisted income maintenance payments.¹⁵ Oral health services under Medicaid are mandatory for children, but are one of about 34 health and health-related services that are considered optional for adults. In difficult economic times, cash-strapped states may cut these optional benefits to save money and preserve other programs. In 2000, 31 state Medicaid programs offered full or limited oral health coverage for adults and seven states offered no coverage. By 2003, when only three states were not facing budget deficits, only 15

states were continuing or proposing to offer full or limited adult oral health benefits, and the number of states offering no coverage had increased to 16. In 2007, 16 states offered at least some oral health benefits in all major service categories, 13 states excluded at least one service category, 16 states offered emergency services only, and 6 states offered no adult services.¹⁶

These program descriptions illustrate the traditionally limited or fragmented coverage afforded to oral health care by public programs. In 2006, state and federal public programs covered 6% of oral health expenditures nationally, but 45% of all personal health care expenditures.¹³ State and federal governments convey an unfortunate message to the public about the importance of oral health by covering virtually no oral health services in Medicare and deeming the coverage of adult oral health services optional for state Medicaid programs. In contrast to medicine, the relative scarcity of dental insurance and the absence of managed care in existing dental plans mean that those people who seek care always have to assume at least some responsibility for their oral health care costs.

The **Children's Health Insurance Program** (CHIP) is a jointly funded federal–state program that provides health insurance coverage for children up to age 19 whose families do not qualify for Medicaid and whose incomes are generally less than twice the federal poverty level (\$22,050 for a family of four in 2009). During Federal Fiscal Year 2008, 7.4 million children were enrolled in CHIP for at least part of the year.¹⁷ Although oral health coverage is not a mandatory component of CHIP (unless the program is an extension of the state's Medicaid program), all states have elected to offer at least some oral health coverage to eligible children. However, the extent of coverage is dependent on funding and, in difficult economic times, states often tend to view oral health coverage as one of the more expendable benefits.

In addition to the major publicly financed oral health care programs noted above, the wide range of community-based programs—community clinics, school-based sealant programs, preschool fluoride programs, nursing home oral health

programs—are funded through various sources, such as federal, state, and local governments; corporate sponsors; foundations and other philanthropic organizations; sliding fee schedules; and private donations. The one thing common to most of these programs is that they are typically underfunded relative to public need and demand.

Insurance is a major determinant of oral health care utilization. Most full-time employees in medium-sized and large businesses are covered for at least some oral health care benefits, but fewer small businesses offer such benefits. Although more than 14% of children younger than 18 have no form of public or private medical insurance, more than twice as many—23 million children—have no dental insurance.¹⁸ In 2006, although more than 15% of persons ages 18 and older had no form of medical insurance, 20% of nonelderly adults and 12% of children had no medical insurance.¹⁹ In 2004, approximately 46 million children (54%) had private dental coverage during the year, whereas about 26% of all children had only public dental coverage and slightly less

than 20% of all children had no dental coverage. Approximately 103 million adults ages 21 to 64 (60%) had private dental coverage during that year, whereas only 5% had public coverage and 34% had no coverage.⁵

Health insurance plans can be broadly divided into two large categories: (i) indemnity plans (also referred to as reimbursement plans), and (ii) **managed care plans**. With indemnity plans, the insurer pays a specific amount for a specific service or set of services; therefore, these plans are often referred to as fee-for-service plans.

There are three basic types of managed care plans: (i) health maintenance organizations (HMOs), (ii) preferred provider organizations (PPOs), and (iii) point-of-service (POS) plans. See Box 2-2 for definitions of these plans. All managed care plans involve an arrangement between the insurer and a selected network of health care providers. All offer policyholders financial incentives to use the providers in that network. There are usually specific standards for selecting providers and formal steps to ensure that quality care is delivered.



BOX 2-2 Basic Types of Managed Care Plans

Health Maintenance Organizations

HMOs, or their dental equivalents (dental maintenance organizations [DMOs] or dental health maintenance organizations [DHMOs]), provide health care services on a prepaid basis, meaning that HMO/DMO members pay a fixed monthly fee, regardless of how much care is needed in a given month. In most cases, HMO/DMO members must receive their care from providers and facilities within the HMO/DMO network.

Preferred Provider Organizations

PPOs are plans under which patients select a provider from a network or list of providers who have agreed, by contract, to discount their fees. In PPOs that allow patients to receive treatment from a nonparticipating provider, patients will be penalized with higher deductibles and copayments. PPOs are usually less expensive than comparable indemnity plans.

Point-of-Service Plans

POS plans are arrangements in which patients with a managed care plan have the option of seeking treatment from an “out-of-network” provider. The reimbursement for the patient is usually based on a low table of allowances, with significantly reduced benefits than if the patient had selected an “in-network” provider.

When managed care programs first began in the 1940s, an underlying principle was that providing and paying for preventive services would ultimately reduce the costs of health care. Even today, many managed care plans are in the forefront of prevention and offer programs that traditional indemnity insurance plans may not cover.

Managed care plans are typically paid a fixed amount per enrollee per month, regardless of whether that individual actually uses the services the plan offers. This arrangement is referred to as **capitation**. Although the plans themselves are capitated, providers participating in the plans may be reimbursed in several different ways (e.g., they may receive a capitation fee, but they may also be paid fee-for-service or be salaried by the plan).

In many managed care plans, a primary care provider (e.g., pediatrician, family practitioner, general dentist, and, sometimes, pediatric dentist) controls referral to specialists (i.e., the patient cannot independently see a specialist). This is referred to as the **gatekeeper** function.

ORAL HEALTH INFRASTRUCTURE AND WORKFORCE

Programs

As noted in the Surgeon General's Report on Oral Health, "The public health infrastructure for oral health is insufficient to address the needs of disadvantaged groups, and the integration of oral and general health programs is lacking."⁴ Infrastructure, as described in Chapter 1, refers to systems, people, relationships, and resources needed to perform functions. A National Call to Action reports that the lack of personnel with oral health expertise at all levels in public health programs remains a serious problem. Public health agencies in particular are experiencing a void in the number of experienced dental public health professionals who can fill management or policy positions, especially due to retirements.

State and local oral health programs vary in funding sources, staffing patterns, and range of

activities. Many federal, state and local dental public health programs are overextended, underfunded and lack highly trained and experienced leadership. Twenty-four states have three or fewer employees working in state government oral health programs; eight states have more than 50% of their state and local health jurisdictions with a population of over 250,000 with no dental programs.²⁰ Differences in state oral health programs are reflected in the annual ASTDD Synopses of State and Territorial Dental Public Health Programs. Numerous national organizations and government agencies are trying to alleviate this situation by promoting **leadership development** through already existing leadership institutes, public policy fellowships, or by creating new opportunities for skill development in public health, management, and information technology. Tools to help states address infrastructure problems are available on CDC's Division of Oral Health web site. The Health Resources and Services Administration (HRSA) also has provided a number of funding opportunities to help states strengthen their oral health infrastructure. Web sites that contain online information related to the content of this chapter are included in the Resources section.

More than 90% of active dentists and dental hygienists work in private practice. Many general dentists and specialists do not participate in public financed programs such as Medicaid or SCHIP, placing a burden on community clinics and other programs that treat underserved populations. Continuing efforts through national groups such as the American Dental Association (Give Kids a Smile), Oral Health America, American Dental Hygienists' Association, The National Foundation of Dentistry for the Handicapped, and Special Olympics promote private sector **volunteerism** to provide free or reduced-fee preventive services and oral health care to individuals who can't afford private sector care, especially children, disabled individuals, and frail elders. This does not begin to solve the dental access problem, however.

In July 2008 an estimated 47.6 million people resided in 3,951 areas designated by the Department of Health and Human Services'

Bureau of Primary Health Care (BPHC) as **Dental Health Professional Shortage Areas (DHPSAs)**.²¹ To meet the 3,000:1 desired ratio of population to dental practitioners in these DHPSAs, 9,321 dental professionals are needed. DHPSAs are geographic areas, special population groups (e.g., low-income or Medicaid populations), or facilities (e.g., correctional institutions) designated by the federal government as having a shortage of oral health personnel. This designation qualifies these entities for various federal programs (e.g., community health centers and sites where health professionals may be able to practice and have all or a portion of their student loans forgiven).

The federal government supports Federally Qualified Health Centers, community/migrant/homeless health center programs located in medically or dentally underserved communities. In 2007 more than 1,000 health centers operated 6,000 service delivery sites in the United States, D.C. and the territories/jurisdictions.²² To increase the proportion of centers that provide on-site oral health care, the BPHC began an initiative in 2002 that required new clinics or expansion of existing clinics to include oral health care to receive funding, so most of these centers now include on-site oral health programs, employing more than 6,800 oral health professionals to provide services including primary and preventive oral health care and outreach. In 2007 more than 2.8 million patients received dental services at health centers, twice as many as in 2001.

Numerous community nonprofit and for-profit clinics have emerged to serve as additional **safety net dental clinics**. The oral health care safety net is where people go because (i) they do not have a regular source of care or they choose it as their regular source of care, (ii) they know there is a sliding fee scale or that their Medicaid card will be accepted, (iii) they will not be turned away when they are in pain and cannot afford care, and (iv) the clinic is close to home, or for various other reasons. It helps people who otherwise fall through the cracks in oral health care. Unfortunately, there are not enough clinics to meet the growing

need and demand for care. The Safety Net Dental Clinic Manual is available online to help communities make decisions about building or expanding safety net clinics.

Another solution to the access problem is to take the services to where populations live, work, or spend a significant amount of time, such as to the schools. Many community-based programs that use self-propelled mobile vans, mobile trailers that are parked at sites, and portable dental equipment that will fit into an automobile or truck are providing services to underserved populations. These **mobile and portable dental services** are particularly efficient for conducting dental sealant programs. An online Mobile and Portable Dental Manual is available to help communities implement high-quality mobile and portable dental care systems.

To address the lack of/maldistribution of dental services in rural or isolated areas, **tele-dentistry** is helping (i) general practitioners seek needed consultation from specialists for certain patients, (ii) dental hygienists practice in areas where a dentist is not always available for diagnosis and consultation, (iii) delivery of continuing education courses, and (iv) dentist-laboratory communication, as well as reducing travel time and expenses for families. Teledentistry uses electronic information and communications technology to provide and support health care provided in distant locations. Digital radiography and other computer and video applications, as well as Integrated Services Digital Network lines, make this type of service possible.

One potential solution to certain access problems is to change restrictive state dental practice acts that prevent dental hygienists from practicing without the supervision of a dentist, that limit state licensure to practitioners who have successfully passed a state clinical board, and that prevent dental hygienists from receiving direct reimbursement from third-party payers, such as Medicaid or private dental insurers. Recent legislation has expanded the role of dental hygienists in several states to promote better access to preventive services and to address these barriers. New models of service delivery are arising in some states and native

communities. This is addressed in more detail in Chapter 4.

Workforce

The oral health workforce, like the general population, is aging, and many professionals choose to work part-time. Some states project they will lose 30% to 50% of their oral health workforce to retirement in the next decade. This situation is mirrored in public health and academic settings. Recruiting members of underrepresented ethnic groups into oral health and allied health professions and into dental public health positions has been difficult. For example, recruitment continues to be a problem for the Indian Health Service and for tribal clinics that want to hire members of their own communities. The number of oral health professionals representing minority groups in the United States is disproportionate to the distribution of these groups in the population. In 2005, underrepresented minorities comprised 12.8% of applicants and 12.6% of first-year enrollees.²³ Most of the increase has been among Asian/Pacific Islander students. In a 2006 study of dental graduates, the least important factor noted for going into dentistry was the opportunity to serve vulnerable and low-income populations, although minority students rated this and service to own race and ethnic group higher than white students.²⁴ The field of dental hygiene is even less ethnically diverse. Relatively few faculty members in dental or dental hygiene schools are ethnic minorities.

These ethnic and cultural discrepancies between the oral health workforce and the general population create a number of challenges. Adequate numbers of role models and mentors are lacking for students and graduates from ethnic minority groups who wish to work in dental public health settings. Designing effective community-based oral health promotion and disease prevention programs that are **culturally relevant** to different groups (incorporating health beliefs, dietary considerations, and communication styles from each group) is difficult. This will be covered more in Chapter 10. Dental hygienists who provide services in large metropolitan school

districts often find themselves working with children and families that represent more than 240 different language groups. Although language assistance for limited English proficient persons (including use of bilingual staff, interpreters, and translation of written materials) has been required for years for programs and health care providers who receive federal funding (including Medicaid and Medicare), resources and monitoring are inadequate. Some programs are training members of the community to serve as **patient navigators** or community health workers to help bridge the communication gap and to assure that people are aware of information, services and financial coverage, and know how to access and use them.

Student indebtedness plays a major role in decisions to enter dental school and then to work in private practice or in public health. In 2006, the mean graduating debt of dental students was \$162,155 compared to \$107,504 in 2002.²⁴ More than 50% reported at least \$150,000 in educational debt. About 33% of the graduating seniors in 2007 reported use of Health Professions Student Loans and 7% received scholarships from one of the uniformed services, the Indian Health Service, or the National Health Service Corps. Twelve percent reported they would be participating in a federal or state **loan forgiveness program** and 4% received need-based federal grants or fellowships. Unfortunately, graduates who practice in the National Health Service Corps or the Indian Health Service to pay off student loans or scholarship obligations often leave after their obligations are finished.

Lower salaries for university faculty and public health positions have deterred some dental and dental hygiene graduates from pursuing these options, despite other benefits that they gain. In 2006 there were 406 faculty vacancies overall and 17 vacant positions in community dentistry/public health.²⁵ Only about 6% of graduating students planned on entering government service immediately on graduation; slightly higher percentages of ethnic minorities, especially American Indian/Alaska Native and Black/African American students, planned on doing so.²⁴ When asked about long-term plans for practice, 1.3% indicated they

would practice in government service and 1.7% indicated teaching/administration or research. Only 0.3% of the seniors had applied for further education in the specialty of dental public health. As of December 31, 2007 there were a total of 218 living dentists board certified in dental public health, 157 of which were certified as active (J. Alderman, *personal communication*, July 27, 2008).

Options for dental hygiene and dental assisting graduates to pursue advanced education in dental public health are limited, although some possess MPH or DrPH degrees. Many do not wish to enroll in a formal degree program but would rather work part-time or full-time and have the opportunity to obtain a specialty certificate or participate in a fellowship or residency program. As you will read in Chapter 4, more online and other programs are being developed to help fill this gap, but specialty certification and fellowships are not yet available. The American Dental Hygienists' Association's Public Health Council may partner with other organizations to create additional options and career tracks.

MOBILIZING ASSETS THROUGH COALITION BUILDING

The role of government in health care has always been a contentious issue and continues to be a focus of arguments on covering the uninsured, prescription drug benefits, cutbacks in Medicaid services, and laws/regulations governing the health care industry. Many public health professionals and members of advocacy groups have turned to community-based solutions to solve health issues and access problems, applying practices from other cultures and countries to arrive at new approaches. The concepts "Think globally; act locally" and "It takes a village to raise a child" are readily applicable to today's crises in health care and oral health care.

Communities are recognizing the need for broad and diverse input into promotion of oral health and provision of oral health services, where anyone can have a role. Coordination of health, education, social, and other services is needed to ensure healthy individuals and healthy communities. Public/private partnerships, **community**

coalitions, and volunteerism are now the primary focus of many funding streams from foundations and government agencies. Staff of governmental oral health programs who are frustrated with the slowness of bureaucracy and an inability to advocate directly with lawmakers are experiencing new successes when community groups advocate for improvements in oral health and leverage various resources to fund and implement programs. Oral health coalitions have helped initiate significant changes in legislation, regulations that impact dental hygiene practice and public financing of care, and promotion of community-based preventive programs. Efforts to develop and implement comprehensive or topic-focused state oral health action plans have been funded by the National Governors' Association, HRSA, Maternal and Child Health Bureau (MCHB), and CDC. Recent communication efforts have focused on increasing the general public's knowledge of oral health, including strategies to advocate with policymakers and legislators for public policy changes and increased resources. Later chapters will provide more information on coalition building.

INTEGRATION OF ORAL HEALTH INTO GENERAL HEALTH AND PUBLIC HEALTH

The Surgeon General's Report, *Oral Health in America*, called for the **integration of oral health and general health**—thinking of the mouth as an integral part of the whole body rather than as separate territory that only dental professionals can enter. This concept is important for assuring the sustainability of community-based oral health programs. Oral health concepts can be integrated into and funded by programs on nutrition, cancer, HIV/AIDS, osteoporosis, birth defects, diabetes, cardiovascular disease, tobacco cessation, prenatal counseling, school-readiness initiatives, efforts to maintain the functional status of the elderly, and military readiness for action.

Integrating primary medical care and oral health care to prevent oral disease in young children has been and continues to be the focus of numerous collaborative projects and publica-

tions. In 1994, the National Center for Education in Maternal and Child Health published *Bright Futures: Guidelines for Health Supervision of Infants, Children, and Adolescents*, a framework for health professionals to provide developmentally appropriate health promotion and disease prevention services to children and their families.²⁶ *Bright Futures in Practice: Oral Health* followed in 1996 to help oral health and other health care professionals address the oral health needs of children within this framework.²⁷ A new edition of *Bright Futures* in 2008 includes a separate chapter on oral health. The basis for these guidelines is (i) **risk assessment**—assessment of risk factors and protective factors for dental caries, periodontal disease, malocclusion, and oral injury, and (ii) **anticipatory guidance**—counseling families about their children’s current oral health status and what to expect at upcoming developmental stages. This approach now has been adopted by many groups and is becoming the cornerstone of clinical and community-based infant and child oral care programs.

Other models for integration include (i) teaching general dentists the skills to treat young children and recognize other childhood health problems, (ii) promoting a child’s first oral health assessment/dental visit by age one, (iii) assuring that each child has a “medical home” and a “**dental home**”—a continuous, accessible source of care, (iv) incorporating oral health screening/referral, education, and fluoride varnishes into primary care and well child visits, and (v) increasing interprofessional education and communication via the Internet. Head Start is another example of a national program that promotes integration of oral health with general health and school readiness.

APPLICATION OF TECHNOLOGY AND SCIENTIFIC RESEARCH

Influence of Information Technology

Health professionals and policymakers today are inundated with information that affects health practices and policy development. Some older

professionals find it difficult to learn new electronic communication systems, putting them at a disadvantage for keeping professionally current. Rapid dissemination of information in various formats through electronic media, particularly the Internet, is enabling people to learn about innovations in a timely manner and to share them with others. It also helps the public advocate for programs and policies directly with legislators in a rapid fashion. Health professionals and policymakers often are in the difficult position of trying to keep ahead of consumer knowledge levels, answer questions based on reliable information, and correct misperceptions due to inaccurate information online. People are more aware of their rights and responsibilities as health care consumers. People with difficulty in understanding and navigating the health care system and communicating with their providers now have more opportunities to find helpful resources and also communicate online. All of these factors are changing the way policymakers, health professionals and consumers communicate.

Health Communication Strategies

New **health communication** strategies are slowly being incorporated into public health approaches to improving oral health. Health communication is the “study and use of communication strategies to inform and influence individual and community decisions that enhance health.”¹¹ Two health communication strategies that are used in public health are (i) **social marketing theory**, a technique used to increase public awareness of the relationship of behaviors to diseases and to influence people to take action,²⁸ and (ii) **media advocacy**, the strategic use of various media outlets and formats to increase awareness and knowledge of issues.²⁹ These concepts are discussed in more depth in later chapters.

FrameWorks Institute has used these techniques in research on oral health for almost a decade, examining the public’s understanding of oral health to help design strategies to engage and mobilize advocates to address this issue. Using this research, funded by the Washington Dental

Service and others, FrameWorks designed and managed a public campaign on oral health for children in the state of Washington, the “Watch Your Mouth” campaign, which has now become a model for replication in other states and communities.³⁰

Other strategies attempt to address the health needs of people with limited English language skills. The National Literacy Act of 1991 defined literacy as “. . . ability to read, write, and speak in English and compute and solve problems at levels of proficiency necessary to function on the job and in society, to achieve one’s goals, and develop one’s knowledge and potential.”³¹ One model for improving health literacy is to integrate health concepts and skills into adult education, General Educational Degree programs, and English as a Second Language classes. Another model is use of “**plain language**.”³² Although there is no standard definition, it means that people who use documents written in plain language can quickly and easily (i) find what they need, (ii) understand what they find, and (iii) act on that understanding.

All of these strategies emphasize the importance of identifying appropriate communication and health promotion approaches for each audience. Because the “one size fits all” approach does not work, programs must learn how to customize

their messages and approaches to different groups to be culturally relevant. Evaluating effectiveness and efficiency of interventions has assumed more importance so that oral health promotion efforts can be more evidence-based. Additional information on creating appropriate communication tools will be presented in Chapter 10.

Evidence-Based Practice

In the last decade, evidence-based health care has served as a catalyst for new avenues for health services research and a focus on health outcomes. The goal of **evidence-based practice** is to facilitate timely translation of research findings into clinical and community practices that result in improved oral health. This requires a decision-making process based on integration of new evidence for effectiveness with expert opinion, clinical and community experience, and professional judgment. Various barriers exist, however, to prevent widespread use of this approach in clinical or certain public health settings (Box 2-3).

Research on **diffusion of innovations** demonstrates that it takes at least 10 years for practitioners to adopt new materials or techniques.³⁴ Research on many new clinical and preventive techniques has not yet been translated



BOX 2-3 Barriers to Implementing Evidence-Based Dentistry

- Insufficient research or inconclusive evidence
- Poor quality research
- Inadequate or ineffective dissemination of evidence
- Faculty not basing their teaching on evidence-based approaches
- Clinicians not reading or hearing about new research or not wanting to learn the new skills
- Expecting clinicians to document and evaluate clinical oral health outcomes for their patients
- Convincing third-party payers to reimburse based on new practice guidelines
- Implementing standard diagnostic codes.

Adapted from Mertz B, Manuel-Barkin C, Isman B, O’Neil E. Improving Oral Health Care Systems in California. San Francisco, CA: UCSF Center for the Health Professions; 2000, with permission.³³

to their use with various population groups in private practice or public health settings. Before evidence-based practice can be fully implemented in clinical and public health settings, however, additional research is needed, especially to develop reliable and valid measures of oral health outcomes. The Cochrane Oral Health Group, one of several groups that perform **systematic reviews**, has completed a number of oral health reviews. ASTDD has established another type of review process for best practices that rates state and community practice submissions on five criteria: (i) impact/effectiveness, (ii) efficiency, (iii) demonstrated sustainability, (iv) collaboration/integration, and (v) objectives/rationale. Reports about dental public health “best practice” approaches to improve the infrastructure can be accessed through the ASTDD Best Practices web site. Additional information about evidence-based oral health promotion programs is found in Chapter 8.

Summary

Many trends in the field of dentistry, dental hygiene, and public health create challenges for students and professionals who wish to work in the field of dental public health. Major challenges include reducing oral health disparities, increasing access to preventive services and oral health care, financing oral care, integrating oral health into general health and public health efforts, mobilizing assets through new collaborations and community partnerships, and using new technologies and evidence-based practices.

New skills that are needed to meet future dental public health challenges include the following:

- Interdisciplinary teams: working with new partners such as social scientists, epidemiologists, evaluation specialists, and health communication specialists.
- Community coalition building: increasing support and ownership for oral health programs, creating solutions to local issues, and assuring sustainability of programs.

- New communication channels: learning to design and disseminate key messages to different target audiences using new technologies.
- Outcome-based evaluation: looking at the impact of programs on oral health rather than just program logistics and numbers of people served.
- Management of young professionals: relating to a group that expects participatory decision making and has different communication skills and work styles, especially in relation to new information technology.
- Methods for imparting dental public health history and experience: making the lessons of the past relevant to the present and the future.

Learning Activities

1. Choose one of five actions cited in the National Call to Action to Promote Oral Health, and discuss ways that you or your class can “answer the call.”
2. Find oral health statistics for your community or state. Compare statistics from 10 or 20 years ago to more recent statistics. How have they changed? What do you think contributed to these changes?
3. Locate online resources about the principles of community-based participatory research and how they relate to cultural relevance. Locate and describe some funded projects that are examples of this type of research applied to oral health disparities.
4. Check the ASTDD web site to see if your state has held a dental summit or Head Start oral health forum. If so, review the reports, action plans, and recommendations. What barriers to care were identified and what were the recommended actions to address the problems? Discuss roles that dental and dental hygiene students and practicing dental professionals can play in implementing the recommendations.
5. Interview someone in the state Medicaid program about how enrollment of families, enrollment of dental providers, and coverage and

reimbursement rates for various oral health services have changed in the past 5 years.

6. View the ASTDD Synopses of State Dental Public Health Programs and compare four states on such characteristics as population, infrastructure, funding sources, and range of programmatic activities.
7. Research what professional leadership institutes or programs are available for dental, dental hygiene, or public health professionals in the United States, and compare them for length and cost, topics and projects, and outcomes reported by alumni.
8. Develop recruitment tools to interest under-represented ethnic groups in public health professions, especially dental public health.
9. Interview the state oral health program director, a member of the state staff, or a city or county dental director to learn ways that oral health is integrated into other health programs and activities.
10. Interview a dental researcher or a member of the dental hygiene faculty. Ask how advances in science and technology have changed the way they do research, access information, and teach in the past 5 to 10 years.

HRSA Bureau of Primary Health Care: <http://bphc.hrsa.gov/>

HRSA Bureau of Primary Health Care Dental Health Professional Shortage Areas: <http://bhpr.hrsa.gov/shortage>

HRSA Maternal and Child Health Bureau: <http://mchb.hrsa.gov/>

Indian Health Service: <http://ihs.gov>

Mobile and Portable Dental Manual: <http://www.mobile-portabledentalmanual.com>

National Foundation of Dentistry for the Handicapped: <http://www.nfdh.org>

National Maternal and Child Oral Health Resource Center: <http://mchoralhealth.org>

National Oral Health Surveillance System: <http://www.cdc.gov/nohss>

NIDCR Dental, Oral and Craniofacial Data Resource Center: <http://drc.nidcr.nih.gov/>

Office of the Surgeon General: <http://www.surgeongeneral.gov>

Oral Health America: <http://www.oralhealthamerica.org>

Safety Net Dental Clinic Manual: <http://www.dentalclinicmanual.com>

Special Olympics Special Smiles: <http://www.specialolympics.org>

Resources

American Association of Public Health Dentistry (AAPHD): <http://www.aaphd.org>

American Public Health Association, Oral Health Section: <http://www.apha.org/>

Association of State & Territorial Dental Directors (ASTDD): <http://www.astdd.org>

CDC Oral Health Resources: <http://www.cdc.gov/OralHealth>

CDC Prevention Research Centers: <http://www.cdc.gov/prc>

Cochrane Oral Health Group: <http://www.ohg.cochrane.org>

Health Literacy Studies: <http://www.hsph.harvard.edu/healthliteracy>

Healthy People 2010 Resources: <http://www.healthypeople.gov>

HRSA Bureau of Health Professions: <http://bhpr.hrsa.gov/>

Review Questions

1. Which of the following persons is least likely to have difficulty accessing dental care?
 - a. A frail, elderly woman who is homebound
 - b. A 20-year-old, male, Hispanic, migrant agricultural worker
 - c. A 40-year-old female American Indian in an isolated Alaskan village
 - d. A 59-year-old state government worker
 - e. A 2-year-old who lives in a single-parent family with his five brothers and is eligible for but not enrolled in Medicaid
2. Which of the following is NOT a true statement?
 - a. Dental caries is the single most common chronic children's disease.
 - b. Over 50% of child abuse cases involve head and oral facial trauma.

- c. Uninsured children are 2.5 times less likely than insured children to receive dental care.
 - d. Less than 200 school hours are lost to dental-related illness each year.
 - e. African American males have the highest incidence of oral and pharyngeal cancers in the United States and their 5-year survival rates are lower than the rest of the population.
3. The Surgeon General's Report, *A National Call to Action to Promote Oral Health*, covers five actions. Which of the following is NOT one of the actions?
- a. Change public perceptions of oral health
 - b. Increase oral health workforce diversity, capacity, and flexibility
 - c. Build the science base and accelerate science transfer
 - d. Overcome barriers by replicating effective programs and proven efforts
 - e. Promote more disciplinary rather than interdisciplinary collaborations
4. All of the following trends may increase access to care EXCEPT:
- a. teledentistry.
 - b. mobile and portable dentistry.
 - c. dental expansion of community health centers.
 - d. more restrictive dental and dental hygiene state practice acts.
 - e. volunteerism.
5. Which of the following is an accurate representation of a current dental public health workforce issue?
- a. Ethnic representation in the dental public health workforce does not mirror representation in the population served by public health programs.
 - b. Too many graduates are applying for dental public health advanced education programs.
 - c. Salaries for dental public health positions are not much different than salaries in private dental or dental hygiene practice.
 - d. Currently, there are many options for dental hygienists to pursue advanced education or credentialing in dental public health.
 - e. The number of dental professionals applying for government jobs has increased in the past few years.
6. All of the following are considered barriers to implementing evidence-based dental public health practice EXCEPT:
- a. the time it takes for practitioners to adopt new research.
 - b. the translation of techniques used successfully in private practice with individual patients to a community-based population approach.
 - c. not having enough scientists to review previous studies.
 - d. the lack of funded oral health research in community-based settings.
 - e. convincing third-party payers to reimburse based on new practice guidelines.

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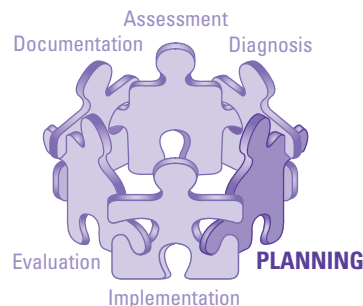
Global Perspectives in Oral Health Care

3

Objectives

After studying this chapter and completing the study questions and activities, the learner will be able to:

- Identify and discuss three influences on an oral health care system.
- Discuss three barriers to access oral health care
- Describe the role and education of oral health care workers around the world.



KEY TERMS

Aboriginal health workers
Atraumatic restorative technique (ART)
Dental health aide therapists
Dental nurses

Dental therapists
Financial barriers
Indian Health Service
Interim therapeutic restoration (ITR)

International Federation of Dental Hygienists (IFDH)
Personal/cultural barriers
Socioeconomic position
Structural barriers

See Appendix 3 for the ADEA competencies addressed in this chapter.¹

Introduction

Perspectives on oral health care are necessarily different in various countries. Perspectives are dependent on many factors including demographics, oral health needs, health care values/beliefs, and educational and health care systems of delivery. Each culture has its own way of meeting the oral health needs of its people. One chapter cannot cover in detail all of the nuances of oral care around the world. The goal of this chapter is to provide an overview of health care providers and systems that will expose the student to other oral health care possibilities and encourage further study.

By its own definition “The World Health Organization (WHO) is the directing and coordinating authority for health within the United Nations system. It is responsible for providing leadership on global health matters, shaping the

health research agenda, setting norms and standards, articulating evidence-based policy options, providing technical support to countries and monitoring and assessing health trends.” In 2003 WHO indicated that because of the high prevalence and incidence in all regions of the world, oral disease is a major public health problem.² This chapter describes factors influencing oral health care systems and examples of the various workforce provider groups involved in the care process in different countries.

INFLUENCING FACTORS ON ORAL HEALTH CARE SYSTEMS

The way each country finances health care plays a role in the type of oral health care provided and how it is delivered. Financing can come

from general government revenues, insurance, or direct payment by individuals receiving care. Most countries have a combination of financial support. When supported by government funds, treatment can be limited to specific types of treatment and/or specific treatments for specific populations. For instance in Russia, mainstream patients pay for their own dentures; however, dentures may be funded by the government for vulnerable populations. Russia provides some dental care for all of its citizens. A national document is published in Russia each year, which determines the services provided by the government revenue and those funded by the patient. When a country like the United States uses a system predominately funded by direct payment from the one receiving care, access to care is limited for those in a lower **socioeconomic position**.

Population age, location, and oral health status have an influence on the design of an oral health care system. For instance, whether the country has more elderly or more children might determine the location of care. Elderly care might be more effective if provided in a nursing home, whereas many countries provide care for children in school clinics. If a large portion of the population lives in rural areas, it may be necessary to deliver care from mobile clinics or use alternative providers. If children in a particular country have a high caries rate and financial resources are limited, the focus of the system might necessarily be on restoring the teeth, whereas if the caries rate was lower, the focus might be on prevention.

Health policy of each country is formulated by politicians using data on oral health needs of their particular population. The policy reflects the health values and beliefs of the culture. Goals and objectives for actions are identified and are facilitated or restrained by available financial support.

Oral health care providers and the educational systems vary in each country. For instance, the education of a dentist varies from a 2-year post-secondary training to 4-year postuniversity degree. There are over 40 countries where dental hygienists practice and 50 countries where dental thera-

pists practice. Dental assistants or **dental nurses** are employed in most countries. Their education varies from university education to on-the-job training.

The combination of all of these influences on oral health care systems makes comparisons between oral health systems and outcomes in different countries difficult. However, with the blossoming of technology, it is becoming easier to share information and compare effectiveness of different systems.

BARRIERS TO CARE

Barriers to oral health care can take many forms. The barriers may be structural, financial, and/or personal/cultural. **Structural barriers** are related to the number, type, concentration, location, or organizational configuration of health care providers. Providers face barriers and economic challenges to developing practices in low-income areas. Many providers have large loan debts, and the cost of establishing a practice in low-income areas can be tremendous. Public programs and community health care facilities in the United States are seeing rapidly increasing caseloads as the result of the high cost of oral health care in the private practice sector, decreasing numbers of providers accepting Medicaid, and a broader definition of dental indigence.

Restrictive laws that prohibit the use of **dental therapists** and dental hygienists to provide services to special or rural populations are barriers to access to care for those populations.

Financial barriers limit access because of a patient's inability to pay for a service, or providers who choose not to provide care for those with limited finances. As described in Chapter 2, currently in the United States, millions of Americans do not have dental insurance coverage, making access to care more difficult.

Personal/cultural barriers inhibit patients from seeking care or following provider recommendations based on personal or cultural beliefs. These beliefs include fear of providers of different cultural backgrounds and races, fear of the system, belief in their own healers, and culturally accepted attitudes and beliefs.

ORAL HEALTH CARE WORKFORCE

Although there are many commonalities in oral health workforce in countries throughout the world, there is variation from country to country as to how each particular role performs. The descriptions below are a general overview of each member of the oral health care workforce.

Dentists

Most countries have dentists who assess, diagnose, and treat oral disease. As mentioned previously, the education of dentists varies between countries. In most industrialized countries, the length of formal education for a dentist is at least 4 to 5 years in a university setting. Dentists may own their own practice, work as an associate dentist, or work in community health centers and government agencies depending on the oral health care system in the country.

Dental Therapists

Dental therapists are also referred to as expanded duty auxiliaries and previously referred to in New Zealand as dental nurses and are employed in over 50 countries. In general, therapists are employed by the government and work on children in the school system. They assess, plan, and treat children of school age providing preventive and restorative care and extractions when necessary. They work under general supervision of a dental officer who is available for consultation and may visit a couple of times per year to do chart audits and other quality assurance tasks.

The education of dental therapists traditionally has been 2 years in length and carried out in technical schools. Within the last decade both Australia and New Zealand, which have a long and successful history with dental therapists, have combined the education of dental therapist and dental hygienist into a dually trained Bachelor Degree in Oral Health. The education is now more commonly in a University setting in these two countries. Statutes are being changed to allow the new oral health therapist to provide services for both children and adults in remote areas.

Dental Hygienists

Dental hygienists exist in 37 countries. The emphasis of service of a dental hygienist is to empower the patient to maintain health in the oral environment. The focus is on prevention, primarily of caries and periodontal disease. Dental hygienists assess a patient's oral health status as well as risk for disease, develop a plan of care, implement the plan and evaluate the results of treatment. Although the focus of practice in most countries is similar, government regulations and other influences tend to be different. In Holland, dental hygienists can own their own dental hygiene practice and many do. There, much of dental hygiene care is funded by the government. In Japan, dental hygienists provide more educational services and often provide assistance to dentists.

The education of dental hygienists in the United States ranges from 2 to 4 years. However, the European Union has decreed that beginning in 2008, dental hygiene education will be at a bachelor degree level.³

The **International Federation of Dental Hygienists (IFDH)** has 26 member countries. It provides a forum for sharing information regarding the practice and education of dental hygienists in its member countries. The web site (www.ifdh.org) lists the member countries and provides information on dental hygiene practice and how to qualify as a dental hygienist in each country.

Dental Assistants

Dental assistants are used in varying degrees in most industrialized countries. Their roles range from limited duties to highly sophisticated tasks. In general, they provide support services for the patient and the dentist. An example would be cleaning up and setting up the room, sterilizing instruments, and greeting and seating the patient. The education varies from on-the-job training to some university education.

Dental Lab Technicians and Denturists

Dental lab technicians work in dental laboratories fabricating appliances and restorations from instructions and materials prescribed by a

dentist. Traditionally they do not provide direct patient care. However, some technicians have taken additional training and are considered to be denturists. Denturists work directly with patients to create and fit dentures.

Other Roles in Oral Health Care

Community oral health workers are used in some countries to provide education and preventive services to people in their community. In some countries they provide emergency care. General health aids and traditional health care workers provide some dental care in developing countries. Nondental providers such as nurses, parents, school teachers, and firemen also are involved in fluoride application and oral health education.

EXAMPLES OF ORAL HEALTH CARE SYSTEMS

The countries described below, except Cambodia, are developed economies. Developed countries account for approximately 1 billion people. Emerging economies account for more than 2 billion, and countries with gross deprivation without infrastructure account for 3.3 billion people. The latter group is concerned with more basic needs such as famine and potable water.⁴ The distribution of the world’s population provides extreme challenges in reducing disparities relating to oral health, as we have not yet been able to provide access to care even in the developed economies. Table 3-1 highlights the differences in the health care workforce in each country.

TABLE 3-1 ORAL HEALTH WORKFORCE

COUNTRY	ORAL HEALTH WORKFORCE	
United States	Dentist	173,574
	Dental hygienist	112,000
Canada	Dentist	18,340
	Dental therapist	300
	Dental hygienist	14,000
	Denturist	2,225
New Zealand	Dentist	1,836
	Dental therapist	660
	Dental hygienist	237
	Oral health therapist (new provider)	Data not available
Australia	Dentist	10,000
	Dental therapist	1,270
	Dental hygienist	850
	Oral health therapist (new provider)	Data not available
Cambodia	Dentist	400
	Assistant dentist	88
	Dental nurses (therapists)	320
	Traditional dentists	300
Russia	Dentists	20,000
	Dental hygienists	1,000
Poland	Dentists	24,200
	Dental hygienists	2,500

United States of America

The United States has primarily a fee-for-service or direct care financial model. This model works well for people who can afford dental services, as there are a wide variety of services available. However, the fee-for-service model leaves many low-income people without access to dental care. Low-income minority children continue to have high rates of oral disease and poorer oral health because access is generally restricted by low dentist participation in Medicaid programs, an overall shortage of dentists to meet the needs of the population, restrictive state laws prohibiting the use of nondentist providers, lack of oral health insurance for patients, and lack of patient awareness and understanding of the importance of oral health.

The dental nurse concept was experimented with in the United States in the early 1970s. Four expanded-function dental hygiene programs were developed in conjunction with dental hygiene educational programs. This research demonstrated no significant difference in performance between the expanded functions of dental hygiene students and dental students.⁵ Similar results were reported in Australia and New Zealand comparing restorations completed by practicing dental therapists to restorations completed by practicing dentists.⁶ In spite of the research results, to date there is no state licensing jurisdiction in the United States that allows a dental hygienist or dental therapist to prepare, place, and finish restorations. There has been movement to increase access to care in many states by changing their dental practice acts and initiating alternative models of care using dental hygienists.

Connecticut developed an alternative model allowing dental hygienists with at least 2 years experience to provide care in public health facilities without a dentist's supervision. In New Mexico, an alternative model was developed as a "collaborative" practice; a dental hygienist may develop a collaborative agreement with one or more consulting dentists. A similar model in Arizona allows dental hygienists to form an affiliated agreement with a dentist and provide

dental hygiene services for children who are below the poverty level. Dental hygiene services can be provided without a prior examination by the dentist. South Carolina allows licensed dental hygienists to provide selected services in public health settings without prior authorization from a dentist, including screenings, oral prophylaxis, and sealants. Washington and Oregon allow hygienists, who meet certain criteria, to work independently under a limited access permit and provide services in alternative settings, such as nursing homes and schools.

Several states also have expanded the services a dental hygienist may provide. Washington, Oregon, Idaho, Minnesota, Colorado, and Ohio allow hygienists to place restorations in teeth prepared by the dentist. In addition, the **Indian Health Service** in Alaska has developed an alternative model of oral health care delivery. **Dental health aide therapists (DHAT)** from remote villages have the education necessary to provide many of the combined services of a dental therapist and a dental hygienist. Initially, they were educated in New Zealand at University of Otago, School of Dentistry. Currently they are being educated in Anchorage, Alaska in partnership with the University of Washington.

Canada

Canada introduced the dental therapist program in 1972. Currently there are approximately 300 practicing therapists, most of whom work in Saskatchewan alongside dentists, dental hygienists, and assistants in the private sector providing fee-for-service care. Therapists who practice outside of Saskatchewan are employed by government agencies and do not provide services for a fee. Therapists have been self-regulated for more than 30 years.⁷

There are 14,000 dental hygienists practicing in Canada. Similar to the United States, each Province and Territory has its own regulations regarding the licensure and practice of the dental hygienist. The majority of dental hygienists in Canada are self-regulated, which means appointed members of the dental hygiene profession establish the rules for their profession.

New Zealand

New Zealand was the first country to use non-dentist providers, specifically dental nurses (now named dental therapists) to help with the acute shortage of dentists and high oral disease rates. In 1925, before the dental therapist was introduced, 78.6 teeth were extracted per 100 teeth filled compared with 2.5 teeth extracted per 100 filled in 1974 after the School Dental Service (SDS) was implemented. The SDS has been so successful in treating caries that currently at the end of a school year there are no untreated caries in children under the age of 13. SDS is used by 97% of children less than 13 years of age.⁷

Oral health care for children in New Zealand is funded by the government and provided by dental therapists in school clinics. Adult dentistry is provided in a private dental practice model and paid for by the patient. Although children receive complete dental care, they may not develop an understanding of the value of oral health or the necessity of continuing dental visits after completing the SDS. Because of this, and the need for adult periodontal care, dental hygienists were introduced in 1989. The first dental hygiene education program began in 1995 at Otago Polytechnic, in Dunedin. The program was moved to the Dental School at University of Otago in 2001. Currently dental hygienists and dental therapists are educated together and receive a Bachelor of Oral Health Degree. There are more than 250 dental hygienists practicing in New Zealand in 2008.⁷

Australia

The Australian dental therapist can be employed through the government or in a private practice under the direction of a dentist. The dentist is solely responsible for the dental welfare of the patient. After 2 years of education, a dental therapist can prepare teeth and place amalgam or composite materials, scale teeth, administer local anesthetic, provide oral health instruction, and take radiographs. There also are over 300 dental hygienists working in Australia, most of whom work in private practice in the cities. Only a few are employed in public health or

in rural areas. Access to health care in rural and remote areas is greatly limited. Because of this, the Australian government has developed **Aboriginal health workers**.⁸ Although approximately 2% of the total Australian population is Aboriginal, they comprise a high percentage of the rural population. Responsibilities of an Aboriginal health worker include screening and assessing, managing health care equipment and facilities, and interpreting information to the patient. An oral health care component was added to the Aboriginal health worker in 1979 that focuses on preventive dental education and noninvasive emergency procedures to effect pain relief.⁸

Cambodia

University trained dentists and assistant dentists work in the public health system in Cambodia. They work in hospital clinics in the big cities. There are also two types of private practice in the country. One type is the university trained dentist, whereas the other is a traditionally trained dentist. Traditionally trained dentists have no formal education, but are trained on-the-job by passing knowledge and skill from father to son. Traditional dentists are culturally acceptable and more affordable than university trained dentists.⁹

More than 80% of the Cambodian population lives in rural areas and does not have access to oral health care. A national survey in 1991 demonstrated high rates of dental caries and periodontal disease. Dentists were reluctant to work in these rural areas due to the lack of facilities and equipment. Working with the Ministry of Health and instituted by World Concern (an American, nongovernmental organization), the dental therapist program was developed in 1992. The program offers a certificate, which requires 6 months of training, and a diploma for 1 year of training. A prerequisite is 1 year of basic nursing education. On completion of the educational program, the dental nurses are given a set of instruments and the materials needed to provide basic preventive and curative needs, which include oral health education,

local anesthetic, scaling, and extraction of teeth.⁹ They also perform the **atraumatic restorative technique (ART)**, which is also referred to in the United States as **interim therapeutic restoration (ITR)**.^{10,11} This provides the population with basic care at a cost the country can afford.

Russia

The government in Russia provides some dental care for all its citizens. Each citizen is assigned a specific clinic. If they visit their assigned clinic, medical care and some dental care are free. Each year a document is prepared by the government to clarify what services are provided. There are also private dental practices in the larger cities. These state-of-the-art practices cater to dignitaries and an elite population. There is demand for esthetic dental services. Meanwhile, dental decay in secondary school children has increased from 60% to 90%. In response to this increase, the government began training dental hygienists in 2001. To date there have been 1,000 hygienists educated. The government oral health service is not set up to employ hygienists, so they either work in private practice or as dental assistants in the government clinics. In the past, stomatologists were trained to perform services much like dental therapists. It was not successful and has been discontinued.³

Poland

Dental care in Poland is financed through public and national service. There are also well appointed private clinics. Dental care is provided by dentists and dental hygienists, who are supported by dental assistants and dental technicians. Training for dental hygienists began in 1983 and the Polish Dental Hygienists' Association was established in 1997. The education of dental hygienists continues to develop, as the European Union required entry-level dental hygiene to be a bachelor degree by 2008. According to Dr. Demiszewski, Chair of Pediatric Dentistry at The Warsaw

Medical Academy, more dental hygienists are needed as 90% of children 6 years and under have dental caries.³

EFFICIENCY OF ALTERNATE MODELS OF ORAL HEALTH CARE DELIVERY

Overall, studies report the cost for providing dental services by a nondentist provider as lower than that provided by a dentist. Studies also indicate that more quality services could be provided at lower cost. This cost–benefit trend has been noted in the medical profession with the introduction of midlevel providers. Nielson–Thompson reported that physician assistants and nurse practitioners could substitute for 63% of physician services at 38% of the physician's cost. It was also reported that nurse practitioners could effectively provide between 75% and 80% of adult primary care services and up to 90% of pediatric care services. Therefore, these professionals can provide quality care to more people at a lower cost.¹²

If the cost to train a nondentist provider who can provide definitive treatment takes one half of the time and resources necessary to train a dentist, it can be anticipated that the cost to deliver care will be lower. Lobene et al. concluded that nondentist providers could increase the dentist's capacity to provide quality treatment for more people at the lowest possible cost.⁵ Roder investigated studies related to the New Zealand dental nurse and found the annual cost per patient was 50% less than care provided by a general dentist.¹³

Success in other countries and research in the United States clearly demonstrate that nondentist providers can be taught to provide basic restorative and emergency care. The use of nondentist providers to perform services traditionally done by the dentist can, in fact, provide greater quantity of services with equal or higher quality at a lesser cost than has heretofore been provided. The time and cost factor to train and produce this nondentist provider amounts to a small fraction of that required to train the traditional dentist. The application of this method

can be a primary factor in meeting the needs of the public, satisfying the ideal philosophy of the profession.¹⁴

GLOBAL PREVENTION EFFORTS

In addition to different models of care delivery, numerous countries have developed prevention and health promotion measures to reduce oral disease rates. These initiatives include community water fluoridation, fluoride supplements, fluoridated milk and salt, fluoride varnish, and xylitol gum. These different health promotion efforts will be described in more detail in Chapter 8.

The oral health disparities across regions and countries present a dynamic challenge in addressing oral disease. The WHO has developed worldwide priority action areas for oral health.² The first action area is centered on the use of fluorides. Not only should community water fluoridation be promoted worldwide where applicable, but also other modes of fluoride therapy, including toothpaste, milk fluoridation, and salt fluoridation. The second action area is associated with diet, nutrition, and oral health. Many oral diseases are affected by changing lifestyles related to diet and nutrition. This is an opportunity to partner with other programs to address common risk factors for disease. Preventing tobacco use and tobacco use cessation is a third action area. This also is an opportunity for integrating with other health promotion programs.

WHO has targeted both ends of the age spectrum. It has launched programs in schools and with youth populations to control oral health risks for young people. In addition, the staggering growth in the older population worldwide presents a challenge, both in numbers of people and the impaired mobility to obtain access to care.

Finally, oral health systems have been targeted for improvement. These include examining various models of care delivery, developing new categories of personnel to fit a country's need, payment systems, information and surveillance systems, and building and strengthening research programs.

Summary

Oral disease is one of the most prevalent diseases in the world, causing considerable morbidity, particularly for disadvantaged populations. To address these problems, many countries have utilized a variety of providers to help ease the burden of care needed with less cost. Many of these successful models of care could be adapted on a wider scope to bring more quality care to more people and complete more pieces of the dental public health puzzle.

Oral disease has many risks common to other diseases affected by lifestyles. Working collaboratively with other health care providers and organizations can provide a more holistic approach to health. The WHO has set priorities for a coordinated effort for addressing oral disease and disparities worldwide. Nations can learn from each other and work together toward these priorities.

Learning Activities

1. Access www.ifdh.org. Pick a member country and describe the types of providers, what is needed to practice in that country, along with the process for gaining employment.
2. Work with a group to describe the “perfect” model of oral health care delivery and provide reasons why it would be successful.
3. Discuss the ethical issues involved in using resources to provide oral health care in a developing country that doesn't have safe drinking water or an appropriate sanitation system.

Resources

World Health Organization: <http://www.who.int>
International Federation of Dental Hygienists: <http://www.ifdh.org>
Global oral health database: <http://www.whocollab.od.mah.se/expl/regions.html>
Oral Health in Cambodia: <http://www.oralhealthcambodia.com/>

Review Questions

- What barriers are faced when accessing oral health care?
 - Structural
 - Cultural
 - Financial
 - Personal
 - All of the above
- Approximately how many countries worldwide use dental therapists or dental nurse providers to provide oral health care?
 - 20
 - 30
 - 50
 - 100
 - 120
- All of the following groups have limited access to oral health care EXCEPT:
 - minorities.
 - poor children.
 - rural residents.
 - people of low socioeconomic position.
 - working professionals.
- Which organization monitors health issues on a global scale?
 - Centers for Disease Control and Prevention
 - European Association for Public Health
 - Pan American Health Organization
 - World Health Organization
 - National Institutes of Health
- Structural barriers to oral health include:
 - the number, type, and distribution of health care providers.
 - personal belief systems.
 - fear of the oral health care system.
 - lack of dental insurance.
 - perceived need for care.
- Alternative models for health care delivery:
 - have been successful worldwide.
 - indicate nondentist providers provide quality care.

- indicate nondentist providers are less expensive to educate.
- indicate that nondentist providers can provide care without supervision
- All of the above.

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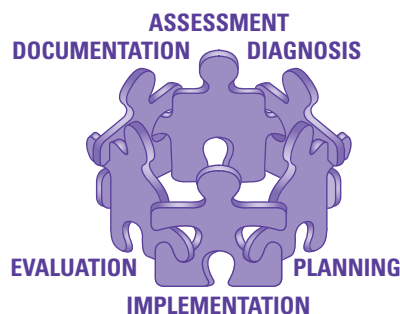
Professional Opportunities in Dental Public Health

4

Objectives

After studying this chapter and completing the study questions and activities, the learner will be able to:

- Compare and contrast dental public health practice with private practice.
- Describe skills and abilities necessary for dental public health positions.
- Describe dental public health opportunities in different sectors of the workforce.
- Identify how dental public health positions are funded.



KEY TERMS

American Dental Education Association

Commissioned Corps

National Spit Tobacco Education Program (NSTEP)

Prevent Abuse and Neglect through Dental Awareness (P.A.N.D.A.)

Special Olympics Special Smiles

United States Public Health Service (USPHS) Women, Infants, and Children (WIC) Program

See Appendix 3 for the ADEA competencies addressed in this chapter.¹

Introduction

What type of person chooses a career in public health? Are you a dreamer, creative, compassionate, people-oriented, innovative, flexible, patient, and organized? Do you enjoy variety, intellectual challenge, bringing people together around an issue, and the reward of helping people attain better health? Public health dentistry may be the career for you!

This chapter explores the many and varied career opportunities for dental hygienists to engage in public health practice and discusses the necessary knowledge and skills to participate at many different levels. Opportunities in this field are only limited by the imagination. The choice to build a career in public health can lead to a stimulating

and rewarding career, as you will discover from the interviews of people who have chosen this field included in this chapter. The multitude of paths that lead from being a learner to a career in dental public health cannot all be depicted in one chapter or even one book. Careers in dental public health encompass a broad scope of activities, including administrative activities, program planning and evaluation, financial management, education, clinical services, legislative activities, personnel management, research, and many other facets of the oral health and business arenas. The job responsibilities of a particular position can vary widely based on the employment setting. The employment settings discussed in this chapter highlight the many contributions dental hygienists can make in the field of public health.

As you read in Chapter 1 and will discover in greater depth in Chapter 5, many of the skills in assessment, diagnosis, planning, implementation, evaluation, and documentation developed as a student clinician in preparation for private practice can be valuable and transferable to public health practice. The profession of dental hygiene is focused on prevention of disease, as is public health. This philosophical cornerstone provides a natural entree into a career in public health. That entree may occur when you provide a presentation to a second grade class about the merits of brushing daily. Public health dental hygienist? Not really, but public speaking ability, good communication skills with diverse groups, and developing appropriate educational tools are necessary skills for a public health professional. The entree may occur when you volunteer on a mobile dental van, treating disadvantaged populations. Public health dental hygienist? Not really, but knowledge of epidemiology, oral health disparities, and financing mechanisms for dental care for disadvantaged populations is important knowledge for a public health professional. You may be asked as a parent to coordinate the school fluoride rinse program using volunteer parents at your child's school. Public health dental hygienist? Not really, but skills in personnel management, program planning and evaluation, and public relations are critical skills for the public health professional. Many small or short-term opportunities are a vital component of the commitment to better oral health for the public, provide a way to explore the field of public health, and become one more piece of the puzzle.

With these opportunities, you may find a desire to pursue a career in dental public health. This chapter highlights opportunities for careers in public health, discusses the skills and knowledge needed, and includes the career paths of people who have chosen to devote their careers to public health.

COMPETENCY IN DENTAL PUBLIC HEALTH

Chapter 1 discussed the most distinctive difference between public health practice and private practice—the concept of the community, rather

than an individual, as the client. Dental public health positions frequently require skills in assessing and diagnosing community oral health needs; planning, implementing, and evaluating community-based oral health programs; providing educational services; applying research and epidemiology; formulating policy; advocating; and understanding the organization of health care and government. The necessary skills and knowledge base are addressed in the various competency documents that have been developed by experts in the field of dental public health.

Several organizations have developed written sets of skills and knowledge required of public health practitioners in different settings. The **American Dental Education Association** (ADEA) provides “Competencies for Entry Into the Profession of Dental Hygiene,”¹ which includes specific core competencies for the newly graduating dental hygienist's complex role in the community (Box 4-1). Dental hygiene programs use this as a curriculum guide for accreditation and for teaching the role of dental hygienists in the community.

The ADEA also lists competencies for other areas of dental hygiene practice. This document is the one from which all competencies for each chapter of this text are drawn. (See Appendix 3) It includes the knowledge, psychomotor skills, communication skills, and attitudes needed in this field of study. These are basic skills for working in entry-level positions in public health. In addition, the American Dental Hygienists' Association (ADHA) developed the Types of Dental Hygiene Careers,² which includes specific roles for dental hygienists: administrator/manager, clinician, advocate, educator, and researcher (Fig. 4-1). All of these roles are encompassed in a public health career and relate to ADHA's mission to improve the public's total health.

Additional organizations have developed competencies for public health professionals. The first is the Council on Linkages Between Academia and Public Health Practice.³ These competencies, developed by the Public Health Functions Steering Committee, relate to the 10 Essential Public Health Services discussed in Chapter 1. Competency in skills and knowledge needed



BOX 4-1 ADEA Community Involvement Competencies for Entry Into the Profession of Dental Hygiene

- CM.1: Assess the oral health needs of the community and the quality and availability of resources and services.
- CM.2: Provide screening, referral, and educational services that allow patients/clients to access the resources of the health care system.
- CM.3: Provide community oral health services in a variety of settings.
- CM.4: Facilitate patient/client access to oral health services by influencing individuals and/or organizations for the provision of oral health care.
- CM.5: Evaluate reimbursement mechanisms and their impact on the patient's/client's access to oral health care.
- CM.6: Evaluate the outcomes of community-based programs and plan for future activities.

From American Dental Education Association. Competencies for entry into the profession of dental hygiene, Exhibit 7. J Dent Educ 2004;68(7):745–749. Available at: <http://www.adea.org>. Accessed June 2009, with permission.¹

Professional Roles of the Dental Hygienist

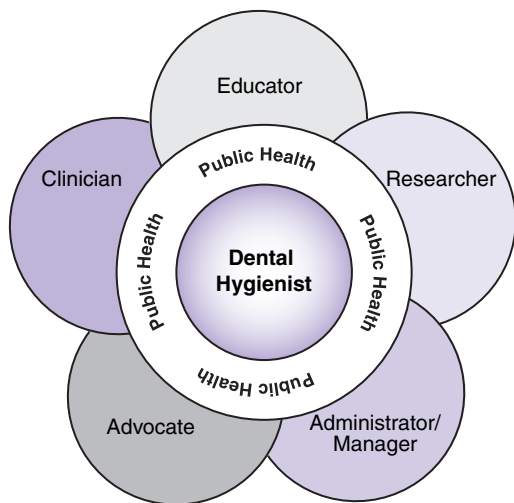


FIGURE 4-1 Professional Roles of the Dental Hygienist. (Adapted from: Types of dental hygiene careers. American Dental Hygienists' Association Online. Available at: <http://www.adha.org/careerinfo/dhcareers.htm>. Accessed January 2009).²

in eight domains or areas for each of the 10 Essential Public Health Services is outlined in the document, including skills in analysis/assessment, basic public health sciences, communication,

community dimensions of practice, cultural competency, financial planning and management, leadership and systems thinking, and policy development/program planning (Table 4-1).

These competencies provide a framework for public health practitioners from front line staff to senior level staff to supervisory/management level staff. More specific and detailed than the ADEA competencies, they are used by federal, state, and local agencies and organizations as a key part of workforce development. The competencies have been used to guide the development of public health courses, curricula, and training priorities.

A second organization that has developed competency statements specifically for dental public health is the American Association of Public Health Dentistry (AAPHD) in conjunction with the American Board of Dental Public Health (ABDPH).⁴ These performance indicators set up the knowledge and practice base by which this specialty of dentistry is recognized. The competencies were developed primarily for dentists seeking to become specialists in dental public health and, as such, require advanced training in dental public health. However, they also are an excellent guideline for any professional in dental public health with advanced responsibilities in their job position (Table 4-1).

TABLE 4-1 COMPARISON OF DENTAL PUBLIC HEALTH COMPETENCIES

CoL SKILL DOMAINS	AAPHD COMPETENCIES	CAPHD COMPETENCIES	ADEA COMPETENCIES	ADHA ROLES
Analytic/Assessment	Program Planning	Oral Public Health Sciences	See Box 4-1	See Figure 4-1
Policy Development/ Program Planning	Selecting Interventions/Strategies for Prevention and Health Promotion	Oral Health Assessment and Analysis		
Communication	Develop, Implement, and Manage Programs	Program Planning, Implementation, and Evaluation		
Cultural Competency	Incorporate Ethical Standards	Oral Health Policy Planning, Implementation, and Evaluation		
Community Dimensions of Practice	Evaluate and Monitor Delivery Systems	Partnerships, Collaboration, Advocacy		
Public Health Sciences	Use of Surveillance Systems	Diversity and Inclusiveness		
Financial Planning and Management	Communicate and Collaborate	Communication		
Leadership and Systems Thinking	Advocate for Policy, Legislation, and Regulations Critique and Synthesize Scientific Literature Design and Conduct Studies	Leadership		

AAPHD = American Association of Public Health Dentistry; ADEA = American Dental Education Association; ADHA = American Dental Hygienists' Association; CAPHD = Canadian Association of Public Health Dentistry; CoL = Council on Linkages.

Sources: Adapted from References 1–5.

The Canadian Association of Public Health Dentistry also has developed discipline competency statements in eight domains (Table 4-1). These domains include oral public health sciences; oral health assessment and analysis; oral health program planning, implementation, and evaluation; oral health policy planning, implementation, and evaluation; partnerships, collaboration, and advocacy; diversity and inclusiveness; communication; and leadership.⁵

These many perspectives on the knowledge and skills needed for public health practice are useful in understanding the nature of public health practice and the various levels at which a dental hygienist may participate in that profession. One may help complete the puzzle as a community-based dental hygienist by participating in the activities mentioned earlier, such as a school fluoride volunteer or volunteering on a mobile dental van with a disadvantaged population. Or, one can choose to pursue a career as a public health professional

by expanding their scope of knowledge and skills and becoming a researcher, state program administrator, or health policy consultant.

The cameos in this chapter highlight the many pathways to a career in public health and the many possible paths available once you have entered a public health career. It is possible to combine a private practice career and a public health career, be involved in improving the public's health solely as a community volunteer, or become a dental public health career professional.

CAREER OPPORTUNITIES IN DENTAL PUBLIC HEALTH

Many careers in public health may be new to dental hygiene students. Most dental hygiene students enter school expecting to enter and remain in private practice for their entire careers. This chapter takes the opportunity to expose

the student to many other career path options. Career pathways in dental public health may develop in many different ways and be funded from many different sources. A position may be at the federal, provincial, state, or county/local level, funded by public tax dollars. It may be in education, research, or industry, funded by public or corporate entities. It could even be as a self-employed contractor or consultant in health policy, prevention, or education, funded by a philanthropic organization, coalition, or health maintenance organization. Perhaps, it may be a volunteer position or other method of becoming involved in the health of the community in which you practice.

Federal/National

Chapter 1 discussed the infrastructure of public health, specifically dental public health. Figure 1-2 identified federal agencies with dental public health responsibilities, many of which offer opportunities for careers in public health (Table 4-2). One of the largest employers of dental personnel in the federal government is the **United States Public Health Service (USPHS)**. The USPHS is under the jurisdiction of the Department of Health and Human Services (DHHS) and provides support for the Agency for Healthcare Research and Quality, the Agency

for Toxic Substances and Disease Registry, the Centers for Disease Control and Prevention (CDC), the Food and Drug Administration (FDA), the Health Resources and Services Administration (HRSA), Indian Health Service (IHS), National Institutes of Health (NIH), and the Substance Abuse and Mental Health Services Administration. The USPHS offers careers in both the civil service and the **Commissioned Corps**. The Commissioned Corps of the USPHS is a non-arms-bearing branch of the Uniformed Services. Dental hygienists who join the Commissioned Corps must hold a bachelor's degree. They are provided the career benefits of uniformed service personnel, similar to the military branches of the Uniformed Services, including medical and dental benefits, vacation and sick leave, retirement, paid continuing education, and advanced training in dental public health and leadership.

Although the DHHS is the primary department responsible for public health activities, additional federal departments with public health opportunities include the Department of Veterans Affairs, Department of Justice (Federal Bureau of Prisons), Department of Defense (military), and the Department of Education. These agencies offer clinical, administrative, educational, or research positions. Many require a minimum of a bachelor's degree in dental hygiene or advanced

TABLE 4-2 FEDERAL OPPORTUNITIES IN DENTAL PUBLIC HEALTH

AGENCY/DEPARTMENT	TYPE OF POSITION
USPHS (Commissioned Corps)	Clinician, administrator/manager, researcher, educator
Department of Justice (Bureau of Prisons)	Clinician, administrator/manager
Department of Veterans Affairs	Clinician, administrator/manager, researcher
Food and Drug Administration	Researcher, advocate
Centers for Disease Control and Prevention	Researcher, administrator/manager, advocate
Department of Defense (Military Installations)	Clinician, researcher, educator
National Institutes of Health (NIDCR)	Researcher, administrator/manager
Migrant/Community Health Centers	Clinician, administrator/manager, educator
Indian Health Service (Commissioned Corps/Civil Service)	Clinician, researcher, educator, advocate
National Health Service Corps	Clinician, administrator/manager, educator

degrees in public health. Indeed, many offer opportunities for repayment of college loans or for sponsored advanced education. Many positions may be through the Commissioned Corps of the USPHS. However, an alternative may be employment in a civil service position, which is employment by the United States Government, similar to a postal worker or other government position. The employee is provided benefits that include medical and dental, vacation and sick

leave, and retirement, if employed in the system for the required period (Boxes 4-2 and 4-3).

State/Provincial/County/Local/City

As with federal opportunities, many choices are available at state or local levels, including positions in state or local oral health programs, state bureau of prisons, Maternal and Child Health (MCH) programs, **Women, Infants, and**



BOX 4-2 Federal Employment Opportunities



CDR Karen Sicard, MPH, JD, RDH

Health Education Specialist

Centers for Disease Control and Prevention, National Centers for Chronic Disease Prevention and Health Promotion, Division of Oral Health Atlanta, Georgia.

Responsibilities include

- project officer for six states providing training and technical assistance in building infrastructure and capacity in state oral health programs.
- project officer for a national organization providing support to state oral health programs.
- project officer for a cooperative agreement to investigate, analyze,

and create resources relating to law and community water fluoridation.

- project officer on four meeting planning contracts.
- lead on the development of a management information system to support state grantees.

What education is required?

The position requires a degree in public health. A degree in an oral health related field is beneficial but not required.

Which of the dental public health competencies/roles relate to your position?

All AAPHD competencies relate to my position, along with all ADHA Professional Roles for the Dental Hygienist except clinician, and all ADEA Competencies except Patient Care and Community Involvement.

How are your program and position funded?

My position is funded through the federal government.

What factors contributed to your decision to work in public health?

I decided to work in public health for a variety of reasons including

- a desire to help people.
- humanitarian goals relating to the betterment of the people.
- to avoid the monotony of clinical practice.

continued

Please describe your career path—where you started and how you ended up in your current position.

I worked in private practice from 1993 to 1997 and joined the USPHS in 1997. I was stationed on an Indian Reservation in Montana as a community/clinical dental hygienist. I worked in the clinic approximately 2 days a week and developed and implemented community prevention programs such as community water fluoridation promotion, sealant program development, and implementation of fluoride varnish programs. In 1999 additional duties were added including areawide oral health prevention activities and the IHS National Oral Health Head Start Consultant providing training and technical assistance to Native American Head Start programs. In 2004, I transferred to the CDC, Division of Oral Health.

Please describe anything else you feel would be important if you were talking to a dental hygiene student considering a career in public health.

Public health is an incredibly rewarding career. Initially the pay can be lower but the long-term benefits greatly exceed the initial lower pay. I think it is important to

- continue to grow and develop through education.
- think outside the box and continue to look for opportunities.

Identify the greatest challenges you find in your public health role(s).

The greatest challenges include scarce resources and the patience to realize that change is slow involving a series of sometimes very small steps.



BOX 4-3 Federal Employment Opportunities



CDR Delores E. Starr, BS, RDH

Aberdeen Area/Regional Dental Prevention Officer
Indian Health Service, Public Health Service

Responsibilities include

- Aberdeen Area dental prevention person and assisting on research projects focused on members of Indian Tribes. Prevention duties include working with the Aberdeen Area Head Start Programs and helping with dental prevention programs.
- Delta Dental grant coordinator to help establish xylitol programs in the Head Start Centers.
- Health Promotion/Disease Prevention grant coordinator from the IHS to help meet the Government Performance Results Act

objectives in the Aberdeen Area by using the grant money to recruit dental hygiene students from the University of Michigan.

- working with a research team from the University of Iowa with a community-based research project focusing on three different reservations. We are also in the process of starting a new study focused on strep mutans. This will be a 4-year project to follow child and mother pairs for 3 to 4 years.

- a recent deployment to help with Hurricane Ike victims.

What education is required?

The position requires a bachelors degree in dental hygiene and some experience in community dental prevention projects, or a masters degree.

How are your program and position funded?

This position is funded by the IHS and supplemented by the grants and other programs (i.e., research projects).

What factors contributed to your decision to work in public health?

The dental decay rates among American Indians are tremendously higher than the national average and this was my opportunity to try to do something to help. I started out doing a lot of clinical work with prevention, which did not seem to help much. I then became interested in working with the research projects to actually see how the problems could be better addressed. I'm an American Indian myself, and I'm very passionate about resolving these oral health problems.

Please describe your career path—where you started and how you ended up in your current position.

I started out as a dental assistant and then continued into dental administration, which included a supervisory position. I knew I could make a bigger difference and decided to go back to school to become a dental hygienist.

I joined the United States Public Health Service (USPHS) as an active military person after I graduated from dental hygiene school. I started out as a Community Dental Hygienist in Phoenix, Arizona and progressed to doing area dental prevention projects to include the three-state area of South Dakota, North Dakota, and Nebraska, as well as part of Iowa. I slowly increased my responsibilities and became a Commander in the USPHS and began working in isolated hardship areas, which included the American Indian population.

Please describe anything else you feel would be important if you were talking to a dental hygiene student considering a career in public health.

I would say they would have to be very passionate about trying to make a difference in the dental health of any program they choose.

Identify the greatest challenges you find in your public health role(s).

When I first started dental hygienists were new to IHS and it was very hard to get programs started and be accepted by the IHS dental staff, because their main duties were focused on provision of clinical services.

Describe the greatest challenges to public health that you anticipate for the next decade.

The greatest challenge for public health will be to continue to provide health services to people in isolated hardship areas. To recruit and retain people to stay in those areas to provide good quality care is very difficult.

TABLE 4-3 STATE, COUNTY AND LOCAL OPPORTUNITIES IN DENTAL PUBLIC HEALTH

AGENCY/DEPARTMENT	TYPE OF POSITION
State/Local Dental Programs	Administrator/manager, clinician, advocate, educator, researcher
Women, Infants, and Children (WIC) Programs	Educator, advocate
Medicaid Programs	Educator, advocate, administrator/manager
Maternal and Child Health Programs	Advocate, educator
Tribal Health Centers	Clinician, educator, advocate, administrator/manager
State Bureau of Prisons	Clinician, educator, advocate, administrator/manager

Children (WIC) programs, and others. These positions can be clinical, educational, administrative, consultative, or even research oriented. They may be in migrant or community clinics, schools, Head Start programs, or tribal clinics (Table 4-3).

In the United States in 2009, there were 10 states in which the state dental director was a

dental hygienist.⁶ In many states, dental hygienists fill key roles in state, county, and local oral health programs (Boxes 4-4, 4-5, 4-6). These roles may involve program management, clinical care, educational programs in schools and other institutions, fluoridation campaigns, sports injury prevention, or developing culturally appropriate educational materials.



BOX 4-4 State Employment Opportunities



Christine Veschusio, MA, RDH

Director, Division of Oral Health
South Carolina Department of Health and Environmental Control (SCDHEC)

Responsibilities include

- Surveillance Coordinator, School Dental Program Coordinator, Fluoridation Coordinator, and CDC Cooperative Agreement Coordinator.
- supervising employees including hiring, determining workload, delegating assignments, training, monitoring and evaluating performance, and initiating corrective or disciplinary actions.
- principal investigator on federal grants.
- overseeing development, implementation, and evaluation of plans and criteria for a variety of activities; assess feasibility of proposed plans, projects and equipment consistent with South Carolina's State Oral Health Plan.
- developing and implementing procedures in response to agency policies and state and federal laws; developing budgets including fund allocation, budget projection, and expenditures; managing contracts and memorandums of agreement; providing technical assistance and consultation to the South Carolina Oral Health Advisory Council and Coalition on dental policy and other practice issues.

What education is required?

The position requires a master's degree in public health or related field.

Which of the dental public health competencies/roles relate to your position?

All AAPHD competencies relate to my position, along with all ADHA Professional Roles for the Dental Hygienist except clinician, and all ADEA Competencies.

How are your program and position funded?

They are funded through federal grants and state funds.

Describe other roles/opportunities you've had as a dental hygienist working in public health.

- SCDHEC School Dental Program Coordinator: Coordinated the activities of school dental prevention programs that provide school-based dental services in South Carolina schools.
- Project Director for More Smiling Faces: Coordinated all activities of South Carolina's State Action for Oral Health Access Program, a pilot project funded by the Robert Wood Johnson Foundation to increase access to oral health for children from birth to age 6, and children and adolescents with special health care needs. Strategies included developing a patient navigation system to link children referred from the medical home to the dental home by age 1, training medical and dental providers and initiating a community oral health education program.

What factors contributed to your decision to work in public health?

Undoubtedly, our careers are shaped by multiple factors. Two profound factors that eventually led me to public health are

- a periodontist, who not only fostered excellence in clinical skills but also provided an educational forum for continued intellectual growth.
- my choice of college for completing my Bachelor of Science degree. The primary goal for advancing my education at that time was to prepare for a career in academia. Under the mentorship of my advisor, each course slowly transitioned my views from the myopic lens of biomedicine to a broader socioecological view. As I completed my BS, I was keenly aware that I had not completed my educational journey. I chose to enter a Master of Arts program in Liberal Studies at the same institution, which in turn allowed me to study dentistry, its professions, its practice, and its policy issues through an interdisciplinary approach. This program gave me a rich educational experience, an enhanced understanding of health care, and the multiple factors impacting the health care system and, most importantly, I learned that there is no "one" solution for improving the health of people.

Please describe your career path—where you started and how you ended up in your current position.

Each segment of my career has shaped my journey as a dental hygienist. Transitioning from private clinical practice to supervision of a dental clinic in a nursing home/medical rehabilitation center gave me an enhanced understanding of the dynamics of health care administration.

Because teaching dental hygiene was my original goal, I chose to accept a position in a dental hygiene program. Teaching community dental health was one of the most rewarding aspects of my career. The students amazed me with their creativity and problem-solving skills as they assessed the oral health issues in their community and developed local interventions. In a sense, it was the enthusiasm of the students compounded with my passion to improve oral health

continued

for all citizens that contributed to my decision to accept a position in a state public health program as a school-based sealant program coordinator. This position eventually led to my current position as director of a state dental public health program.

Please describe anything else you feel would be important if you were talking to a dental hygiene student considering a career in public health.

Public health offers dental hygienists many areas for career growth and enhancement from health education, epidemiology, evaluation, health policy, and planning of population-based disease prevention/health promotion interventions. Hygienists need not limit themselves to oral health. They can have a powerful influence on many other health issues (i.e., tobacco use, obesity, cancer). My advice would be to seek a mentor in a public health position.

Identify the greatest challenges you find in your public health role(s).

The greatest challenge in my current position is funding to support strong state dental public health infrastructure. Leadership positions for surveillance, evaluation, coalitions, health education, community water fluoridation, and school-based sealant programs are essential components needed to move oral health forward in states.

Describe the greatest challenges to public health that you anticipate for the next decade.

There are several important challenges to public health. These include how to

- enhance states' ability to support dental public health infrastructure.
- increase the effectiveness of the dental public health workforce.
- maintain and grow fluoridation of community water systems.
- fund research focused on dental public health related interventions.
- maintain strong oral health partnerships and coalitions.
- ensure that all children at risk for dental caries have access to dental sealants.

Hygienists can play a vital role in enhancing the public health workforce!



BOX 4-5 County/Local Employment Opportunities



Matthew Crespin, BS, RDH, CDHC

Oral Health Project Manager

Children's Health Alliance of Wisconsin Children's Hospital of Wisconsin

Responsibilities include

- advocating for initiatives such as oral health, asthma, lead poisoning elimination, and injury prevention. We are a nonprofit agency focused on children's health issues. We do not provide any direct clinical services.
- coordinating the statewide school-based dental sealant program comprised of 21 programs around the state. facilitating and

managing the statewide oral health coalition, which focuses on access to care issues for children and families in Wisconsin.

What education is required?

The position requires at least an associate degree in dental hygiene, but a bachelor's degree is preferred. I have a Bachelor's Degree in Health Sciences and Dental Hygiene from Marquette University. Additionally, I have a Community Dental Health Certificate (CDHC) from Northeast Wisconsin Technical College where I am now an adjunct faculty member responsible for two courses.

How are your program and position funded?

My position is funded through a variety of grants focused on oral health. The funding comes from the state general fund, federal grants (HRSA and MCH), and significant funding from Delta Dental of Wisconsin.

Describe other roles/opportunities you've had as a dental hygienist working in public health.

I have had the opportunity to write and receive a grant that is currently being implemented in the inner city of Milwaukee. The focus is on coordination of care. A case manager works with families to increase participation in the program and helps clients in accessing appointments for restorative care, if needed. The coordinator also helps families enroll in BadgerCare—the state Medicaid program.

I have been able to work as a “screener” for the statewide third grade and Head Start oral health surveys that Wisconsin has completed over the past 2 years. In addition, I am able to serve on the boards of several clinics that serve low-income and uninsured patients in Milwaukee and Waukesha counties and provide input on evidence-based practices.

What factors contributed to your decision to work in public health?

The education I received at Marquette University contributed greatly to my decision to work in public health. Working in the inner city of Milwaukee, I enjoyed the connection to the community, and after working in private practice in suburbia for several years, I knew that I wanted to be able to contribute to the community. This position has given me that opportunity.

Please describe your career path—where you started and how you ended up in your current position.

After graduation, I worked in private practice for about 4 years for one large practice. I enjoyed the practice and the work I was doing, but knew there had to be more I could do with my skills and leadership ability. I decided to look for opportunities in the public health sector. I have been in my current position for 3 years.

Please describe anything else you feel would be important if you were talking to a dental hygiene student considering a career in public health.

Public health has provided very rewarding experiences. I am very surprised at how much more I have learned about dentistry in these 3 years. Working in public health has provided ways for me to help the most vulnerable of populations. There is nothing like the feeling I get when I see a child who has never had dental care smile again—because of the work I have done. What a great experience!

Identify the greatest challenges you find in your public health role(s).

It is a very political field and there is much controversy. I enjoy this aspect of public health but it can be very trying at times resulting in really getting down on yourself if you are not successful. You have to remember that you are only one person and you can only do so much with the extremely limited funding that is available.

continued

Describe the greatest challenges to public health that you anticipate for the next decade.

I think the primary populations served through public health programs will continue to grow and, unfortunately, I don't think the funding will keep up, thus creating the need for very innovative and effective ideas.



BOX 4-6 County/Local Employment Opportunities



LeeAnn Hoaglin Cooper, BS, RDH, EFDA

Public Health Dental Hygienist, Snohomish Health District, Washington State; Consultant, Association of State and Territorial Dental Directors; Adjunct Faculty, Eastern Washington University and University of Washington

Responsibilities include

- assessment, planning, implementation, and evaluation of community oral health programs.

What education is required?

The position requires a bachelor's degree.

Which of the dental public health competencies/roles relate to your position?

All AAPHD competencies, ADEA competencies of community involvement, health promotion and disease prevention and ADHA roles of educator, researcher, administrator/manager, and advocate relate to my position.

How are your program and position funded?

The salaried position is government funded with local, state, and federal dollars. Grant funds (local, state, or federal) are occasionally sought to begin new programs.

Describe other roles/opportunities you've had as a dental hygienist working in public health.

I have had opportunities to work with a variety of people and a variety of settings. I have learned from groups of new immigrants from Russia, Somalia, Iran, and Southeast Asia, using interpreters to talk about their homes and oral health practices.

I have traveled to remote communities, accessible only by boat or airplane, to provide oral health screenings. I have also traveled to many different states and the largest cities for public health conferences.

I have participated as a member of a well child "team" of pediatricians, public health nurses, licensed practical nurses, nutritionists, and social workers providing preventive health care to uninsured families.

I have had the opportunity to subscribe to many journals, learning to critically analyze dental literature and to apply information into strong and effective policies for preventive dental care. Literature reviews of preventive dental care research are part of my weekly, if not daily, routines.

What factors contributed to your decision to work in public health?

I felt like I wasn't making the kind of difference for people that I had expected to make when working in private practice. We were doing quadrant amalgam restorations every day. I wanted to prevent the problems, not just "treat" problems. I wanted to do more.

Please describe your career path—where you started and how you ended up in your current position.

In 1967, I was introduced to dentistry as a summer dental assistant to a periodontist that encouraged me to consider dental hygiene school. I completed my Associate Degree in dental hygiene in 1974 and practiced for 5 years in a variety of clinical practices, providing expanded functions of anesthesia, restorative and periodontics. I was introduced to dental public health working for a local health department in Eastern Washington in 1977. The idea of influencing children, before dental disease was rampant, appealed to me. I agreed to try it only if I did not have to speak to large groups of people. (My recruiter/friend sort of "fibbed".) I was sent to observe a classroom presentation about the fluoride mouth rinse program. When the presenter was unable to arrive, I had to step in. I did not die talking to the unexpected 400 elementary children waiting in the auditorium at that first "gig." I have since learned that engaging an audience can be fun and gained confidence that I could do more than I thought I could.

Later I organized a local survey of oral health status to determine if we were making a difference with the fluoride mouth rinse program. In the early 1980s my program was eliminated with the economic downturn. I returned to school and completed my bachelor's degree at the University of Washington program in 1982, with a focus in public health and adult learning. I worked in clinical practice again until a new public health position opened up with Snohomish Health District in 1987, where I remain today.

I provide community assessment using the Association of State and Territorial Dental Directors (ASTDD) Basic Screening Survey, Health Professional Workforce Surveys, and others, to build and support oral health programs via community coalition work. Our local coalition works together to integrate oral health strategies within local community agencies and programs. In the early 1990s, my first community project resulted in a successful water fluoridation effort resulting in a shift in funding from the fluoride mouthrinse program to a professional education campaign on dental sealant utilization. We have a school-based dental sealant program, centralized community referral system, and oral health efforts for Head Start programs.

In 2008, after demonstrating proficiency consolidating fluoride evidence into policy resolutions as a volunteer, I was hired as an ASTDD consultant to the Fluorides Committee. I also teach dental public health for dental hygienists, merging my efforts from local work, to state and federal collaborations.

Please describe anything else you feel would be important if you were talking to a dental hygiene student considering a career in public health.

For me, public health has been about being passionate and persistent in creating environments in which people can achieve oral health. It has meant learning to listen, understand, prioritize and respect multiple points of view to work collaboratively with individuals, families

continued

and communities. It requires self-motivation to critically analyze evidence and offers amazing opportunities to be creative in designing strategies to move communities toward disease prevention. There is no “regular” schedule to measure the days; rather work is measured by progress toward the goals and objectives reviewed annually. My career in dental public health continues to be tremendously independent, diverse, and satisfying.

Identify the greatest challenges you find in your public health role(s).

Dental public health requires being prepared to work and prosper with significant ambiguity and uncertainty in directions and funding. I have found that my greatest personal challenge has been accepting, that while community change is slow, the benefits are worth it.

My favorite saying, “Cavities and fillings are a failure of the dental professional to prevent and control the disease of dental caries or to develop successful collaboration with the patient and community.”

Describe the greatest challenges to public health that you anticipate for the next decade.

The ongoing misconception that dental public health is primarily the provision of clinical dental services for people who are poor distracts from the central roles of public health in developing effective strategies for overall health improvements for all people. Improvements in oral health care do not necessarily rely upon access to dental health services, but that the services delivered are affordable and effective for individuals and communities. As the price for all health care services continues to escalate, maintaining funding and the cost saving benefits of dental public health practice will remain challenging.

In Native American communities, tribal clinics provide a wide variety of opportunities, based on the particular oral health needs of the tribal community. This setting often is a way to combine clinical services with community-based health education or health promotion activities. Providers in these settings may be hired from the USPHS Commissioned Corps or directly from the surrounding community. Tribes may also offer student loan repayment opportunities as an employment incentive.

Education

Public health opportunities in the educational setting include teaching and mentoring the next generation of dental professionals regarding their role in the community. It may also include managing an outreach program or clinic for the educational institution or developing educational opportunities in public health for student exploration. This can involve partnerships with other interested stakeholders to provide oral

health care and education for the people of the region. In addition, the educational setting lends itself to research opportunities. Collaborative partners and populations for study may be readily available, and many faculty appointments require research to obtain tenure and for career growth within the institution. In many cases, advanced degrees in public health, health education, health promotion, or other related fields may be required (Table 4-4) (Box 4-7).

Research

Research opportunities are available in educational institutions, but they are also available with private industry, health departments, or philanthropic organizations. Dental hygienists can participate as principle investigators, which may require an advanced degree (usually at the doctoral level) to compete in the world of research grants. However, a dental hygienist also can become involved as a study coordinator to oversee the process of the research or as a research



BOX 4-7 Education Opportunities



Joanne Clovis, DipDH, BEd, MSc, PhD

Associate Professor, School of Dental Hygiene
Dalhousie University in Halifax, Nova Scotia, Canada.

Responsibilities include:

- teaching population health to dental hygiene and dentistry students.
- several research studies related to dental public health.

What education is required?

Full-time positions in university-based dental hygiene programs generally require educators to have at least a masters degree in dental hygiene or a related field, but preference is given to candidates who

have doctoral education.

Which of the dental public health competencies/roles relate to your position?

All AAPHD and CAPHD competencies relate to my position, along with all ADHA Professional Roles for the Dental Hygienist, and all ADEA competencies, with greatest focus on Health Promotion and Disease Prevention and Community Involvement.

How are your program and position funded?

The dental hygiene program is funded by the Governments of Nova Scotia and Canada, and donations from individuals and organizations. My faculty position is funded directly by Dalhousie University. My research is funded by several granting agencies including the Canadian Institutes of Health Research, Health Canada, the Government of Nova Scotia, the Nova Scotia Health Research Foundation, and the Canadian Dental Hygienists Association. The field experiences I have developed for students are collaborative partnerships with many community agencies and health care facilities.

Please describe your career path – where you started and how you ended up in your current position.

My career began in public health in Alberta, Canada. I received a bursary (scholarship) to contribute to my dental hygiene education program with a return-in-service commitment to work in public health for two years. Those two years took me into schools, health clinics, and homes in northern and remote Alberta communities with Metis, First Nations, Francophone and blended populations. Those experiences were my introduction to public health with a diversity of cultures and population needs, and the beginnings of my understandings regarding the determinants of health. Those early experiences also confirmed for me how fortunate I was that my circumstances in life allowed me to live in the safe, clean, and loving environments of my particular family and community.

Somewhat later I taught Inuit children in public schools in the Northwest Territories. I provided toothbrushes, paste, instruction and time to use these mouthcare aids in my classrooms, which, luckily for us, had sinks. After returning to southern Canada, I participated in a three-month dental public health project in the British Virgin Islands. On returning to Canada, I accepted a position as a dental health consultant with the Government of Alberta, consulting to 27 public health districts. During that time, I completed my Master of Science with a research project related to the effects of fluoride in drinking water. In 1988, I accepted my current

continued

position at Dalhousie University and expanded my teaching and research, with the addition of a PhD in Interdisciplinary Studies.

Throughout my career, my teaching, service, and research have been focused on aspects of public health. I have come to understand that dental public health in its broadest meaning is something we practice in our everyday lives.

My professional career has spanned a broad range of private practice, public health, administration, government consulting, and public, interprofessional, dental and dental hygiene education. I have been invited to contribute to many oral health initiatives by government, professional, and research organizations. I have served as President of the Canadian Association of Public Health Dentistry, and I am an Honourary Lifetime Member of the Canadian Dental Hygienists Association. My commitment to public health has been demonstrated throughout my career in frontline service, management, consulting, education, and research.

What factors contributed to your decision to work in public health?

The bursary (scholarship) I accepted to assist me in my dental hygiene education required me to take externship training in a public health district between my first and second years of dental hygiene education. That experience was the foundation of my commitment to public health, a path of professional life that grew and evolved throughout my career of more than 40 years.

Please describe anything else you feel would be important if you were talking to a dental hygiene student considering a career in public health.

In Canada in the past decade, there has been a renewed interest in public health with new federal agencies for public health and dental public health, an increase in the number of graduate public health education programs, the development of competencies for public health and dental public health, and new research funds directed to the disparities in oral health. At no other time in my career have I felt so encouraged by the movement and the momentum in public health in Canada.

Identify the greatest challenges you find in your public health role(s).

Not having enough time and energy to commit to all that I would like to do is a huge challenge. The needs and my interest and motivation are great, but the resources are limited. Our collective social responsibility for health and health care is another inconvenient truth that is so clearly identifiable in public health.

Describe the greatest challenges to public health that you anticipate for the next decade.

In Canada, oral health is beginning to take its rightful place in health care and this is true in both the private and public spheres. Competing demands and priorities, however, require that we carefully assess the needs and apply the limited resources in public health, recognizing that there are no universal solutions. In times of economic distress, the social fabric of our societies is worn thin, and public health services are often seen as somewhat expendable. Although this may appear to be an easy solution to the distribution of limited resources, it is the strength of collective thought and action grounded in commitment to our social responsibility that can create the meaningful partnerships needed to advance health for all. Innovation in knowledge translation and health literacy will be fundamental in our initiatives to improve the health of all populations. These concepts are critical at every stage of sharing and using new knowledge about health.

TABLE 4-4 EDUCATION AND RESEARCH OPPORTUNITIES IN DENTAL PUBLIC HEALTH

AGENCY/DEPARTMENT	TYPE OF POSITION
Educational Institutions	Educator, researcher, clinician, administrator/manager
Student Health Centers	Administrator/manager, clinician
Schools of Public Health	Educator, researcher
Federal Opportunities	Researcher, administrator/manager

associate who may be responsible for collecting data for the study (Table 4-4).

Industry/Corporate

Many dental product companies have educational divisions that target specific population groups for educational programs (Table 4-5). In addition to marketing a product or improving name recognition, these programs help improve the public's health and therefore are another piece of the puzzle. Employment of dental public health professionals to help target populations and develop culturally appropriate educational materials can

be of great benefit to the public's oral health. In addition, as part of their corporate mission, companies may also provide avenues for giving back to the community. This is achieved by providing web sites for consumer information, educational tools for college and university faculties, and classroom kits for teachers in elementary schools. All of these avenues promote oral health, and dental public health professionals are a natural fit for collaborating with corporations to accomplish this goal.

Large provider organizations, or health maintenance organizations, seek ways to target prevention efforts with their programs to provide

TABLE 4-5 INDUSTRY/CORPORATE/PRIVATE/VOLUNTEER OPPORTUNITIES IN DENTAL PUBLIC HEALTH

AGENCY/DEPARTMENT	TYPE OF POSITION
Dental Products Companies	Educator, researcher, administrator/manager, advocate
Contractor/Consultant	Educator, researcher, administrator/manager, clinician, policy analyst, consultant, advocate
Health Policy	
Head Start	
Nursing Home Program	
Epidemiology	
Collaborative Practice	Clinician, advocate, educator
Corporate	Clinician, researcher, administrator/manager, advocate
Volunteer	Advocate, clinician, consultant, educator
Health Fairs	
Legislative Efforts	
Mobile Dental Vans	
Health Coalitions	
Special Olympics	
Schools	
National/International	



BOX 4-8 Corporate Opportunities



Kristen Simmons, BSDH, RDH, LAP

Vice President, Clinical Development Division
Willamette Dental Group
Portland, Oregon

Responsibilities include:

- overseeing the training, education, research and quality for 200 dentists and dental specialists and 150 dental hygienists in 55 offices in Oregon, Washington and Idaho.
- I hold a Limited Access Permit (LAP).

What education is required?

This position requires a Bachelor's degree, but a Master's degree is encouraged.

Which of the dental public health competencies/roles relate to your position?

All AAPHD Competencies relate to my position, along with ADHA Professional Roles for the Dental Hygienist, except Researcher. Many of the ADEA Competencies also apply.

How are your program and position funded?

My position and work are funded through a private corporation.

Describe other roles/opportunities you've had as a dental hygienist working in public health.

Our practice sees patients under the Oregon Health Plan (OHP), which operates under a waiver from the federal government allowing us to serve more low-income people using federal Medicaid money. The state, with input from the community, has an innovative system that prioritizes health care, using a list of hundreds of conditions and their treatments. Higher priority is given to conditions that can be successfully treated, and promote avoidance of illness through preventive care. Currently, we are working on a disease management program with pregnancy, tobacco cessation, hypertension and diabetes.

What factors contributed to your decision to work in public health?

I believe that everyone should have reasonable access to affordable health care creating an equitable health care system where we stop treating care like a commodity rather than as a public good.

Please describe your career path – where you started and how you ended up in your current position.

I started out working in private practice, continued to a group practice, and became a lead dental hygienist/trainer with Willamette Dental Group. I continued with Willamette and was promoted to Manager of Clinical Support. I continued my education and earned a Bachelor's degree in dental hygiene and then moved into a role as the Director of Dental Hygiene, and then my current role of VP of Clinical Development. I am currently working on my Masters of Healthcare Administration (MHA).

Please describe anything else you feel would be important if you were talking to a dental hygiene student considering a career in public health.

Public health confronts and deals with complex issues facing our society. The career is dedicated to protecting the health of the public. The field of public health has many varied job

opportunities to apply skills whether you like crunching numbers, conducting research, or working with people.

Identify the greatest challenges you find in your public health role(s).

Cost, quality, and work force integration.

I feel the greatest challenge ahead will be the “integrator.” This is the entity that accepts responsibility for all three of these components. An effective integrator would work to change the culture of health care to healthy people, rather than restricting access, shifting costs, or administrative red tape.

Describe the greatest challenges to public health that you anticipate for the next decade.

I believe health care policy will need homogenizing of marketplace fixes and government intervention to accomplish President Barack Obama’s plan for a healthy America. Without building upon the existing strengths of the current health care system and innovative state programs, partisan agreement and swift action will not be sufficient to meet the growing demand of health care needs.

I like the objectives set forth by the Oregon Health Fund Board:

- Bring everyone under the tent
- Set high standards
- Unify purchasing power
- Stimulate system innovation and improvement
- Ensure health equity
- Train a new health care workforce
- Advocate for federal changes

cost-effective care for members. A dental hygienist’s knowledge and skills are particularly valuable in these corporate entities (Box 4-8).

Private Contractor/Consultant

Many public health employment opportunities are created by a desire to solve a problem and find a creative approach to funding the solution. Public health professionals may create their own positions in this way, which requires initiative, skill at marketing an idea, and the patience to see it come to fruition. Are you self-directed, articulate, diplomatic, and productive? Do you have strong skills in scientific writing, public relations, marketing, and business management? Self-employed consultants and contractors have the opportunity to set their own hours, schedule, and remuneration and can decide with which projects they would like to be involved. However, the opportunities

may not always provide a consistent paycheck or benefit package and there may be slack times.

Public health professionals are employed as consultants to federal, state, or local agencies. Agencies may be able to provide short-term support for a specific program, develop an educational program, or research a particular problem and develop policy statements relating to the issue. Consultants may have several concurrent projects and may choose projects according to their particular expertise or interest. For example, an oral epidemiologist may focus on performing oral health surveys to determine the oral health status of specific communities or groups. An oral health policy analyst may focus on how the state can best manage Medicaid funding to provide the most services with limited funds. An oral health education consultant may help a school system develop an oral health education program for the school district (Box 4-9).



BOX 4-9 Private Contractor/Consultant/Researcher Opportunities



Kathy Phipps, DrPH

Oral Health Research Consultant

Association of State and Territorial Dental Directors; Northwest Portland Area Indian Health Board; First 5 San Luis Obispo County; Oglala Sioux Tribe

Responsibilities include:

- data management, data analysis, development of oral health research protocols, and continuing education seminars for medical and dental providers.

What education is required?

This type of position requires knowledge of two general areas; oral health and epidemiology. Generally, an oral health researcher or research consultant will have a doctoral degree.

Which of the dental public health competencies/roles directly relate to your position?

All AAPHD competencies relate to my position, with the exception of advocacy, and planning, implementing, and managing oral health programs. The ADHA Role for Dental Hygienists, Researcher, also applies to my position. In addition, the ADEA competencies involving ethics, continuous self-assessment for lifelong learning, promoting the values of oral health, and assessing oral health needs of the community relate to my position.

How are your program and position funded?

Most of the services that I provide are funded through federal grants, along with grants from private non-profit organizations.

Describe other roles/opportunities you've had as a dental hygienist working in public health.

As a hygienist working in public health I have been able to travel extensively and work with a wide variety of different agencies and organizations. Because my consulting contracts are of limited duration and change every few years, I am always working on a new and, in my opinion, exciting project geared toward improving oral health.

What factors contributed to your decision to work in public health?

After graduating from dental hygiene school, I practiced for one year. I enjoyed oral health but did not like working in a dental office. Public health gave me the opportunity to use my dental hygiene skills in a setting that allowed me to work with groups of individuals.

Please describe your career path – where you started and how you ended up in your current position.

Over the years my career path has taken several sharp turns. After hygiene school I practiced for one year before making the decision to go back to school for a degree in public health. The University of Michigan offered me a scholarship, so I attended there for a Master's in Public Health (MPH). I then left the dental field for several years and worked as a health administrator for an Indian tribe and a senior service agency. The next sharp turn was the opportunity to obtain a doctoral degree in oral epidemiology from the University of Michigan. I received a DrPH and

began a career as an oral health researcher in a medical/dental school setting. Family along with the desire to live in a small town eventually led me to leave the University and become a consultant. I truly enjoy my current career and plan on working in this capacity for many years.

Please describe anything else you feel would be important if you were talking to a dental hygiene student considering a career in public health.

If you are inquisitive and are always asking “why” and want to know more about the science behind dental hygiene, then consider becoming a researcher. To decide if oral health research might be right for you, take a basic epidemiology or research design class. In my opinion, all dental hygienists should make the effort to obtain a bachelors degree.

Identify the greatest challenges you find in your public health role(s).

One of my biggest challenges is to find funding for ongoing research projects.

Describe the greatest challenges to public health that you anticipate for the next decade.

In poor economic times, access to dental care becomes a problem for a large number of individuals. I think the greatest challenge to public health will be the development of a dental care system to service those without private dental insurance.

Many states now are looking at alternatives to meet the oral health needs of their residents. Many have changed practice acts to allow dental hygienists to practice under general supervision or unsupervised in settings outside private practice. In these settings, dental hygienists have started their own businesses and are developing innovative ways to facilitate care for those who are unable to receive treatment or who are unlikely to seek care in a dental office. In these settings, dental hygienists must be their own business manager and public relations person. Good marketing and communication skills are a necessity. Also, good collaboration with local oral health providers is important to facilitate care that cannot be provided by the dental hygienist (Box 4-10).

Volunteer

Volunteer opportunities abound and provide a way to learn about public health, network with other professionals, and develop skills without a major time or monetary commitment. Time commitment is flexible—1 day per month on a volunteer van, a few hours per week or month at a school, or one to two weeks per year in another country can all provide variety and increased

career satisfaction. In addition, these activities can increase flexibility in your long-term career progression. There is no limit to possibilities in local, regional, or international arenas. Local, national, or large regional organizations are a good place to look for volunteer opportunities. The **Special Olympics Special Smiles (SOSS)** program holds events in many areas throughout the United States. Different levels of participation are available—from local coordinator to a few hours volunteering with the athletes.

Prevent Abuse and Neglect through Dental Awareness (P.A.N.D.A.) provides opportunities for training dental and other health professionals about dental and orofacial signs of abuse and neglect. If your interest is in preventing tobacco use, the **National Spit Tobacco Education Program (NSTEP)** or your local cancer society are places to begin finding information about health promotion efforts.

There are also large regional medical and dental nongovernmental organizations (NGO) that provide opportunities both locally and internationally for professionals to contribute expertise (see Resources). Opportunities may be with children, teens, or adults. Bilingual health care providers are especially in demand for these organizations.



BOX 4-10



Michelle Gross-Panico, MA, RDH

Affiliated Practice Dental Hygienist
CHW East Valley Children's Dental Clinic
Catholic Healthcare West, Chandler Regional Hospital Chandler,
Arizona; Associate Director, A.T. Still University

Responsibilities include:

- providing preventive dental services to underserved children in an affiliated practice, school-based, preventive dental clinic including dental examinations, risk assessments, radiographs, dental prophylaxis, sealants, fluoride varnish, oral health education, referrals and other care permitted by licensure and affiliated practice agreement.
- assisting with research for and writing of grants to fund the dental clinic, attending planning meetings, communicating with multiple departments of the hospital to ensure compliance.
- developing policies and procedures for the dental clinic, completing hospital and state inspections and JCAHO Accreditation of the dental clinic.
- creating and maintaining database and data collection tools that monitor the population's oral health.
- setting up the school-based preventive dental clinic by ordering and assembling equipment and attending training sessions on equipment and software.
- educating dental students and dental hygiene students on how to deliver services at the community-based clinic using portable equipment.
- managing clinic volunteers and dental assistants.
- developing partnerships with community members.

What education is required?

Affiliated Practice Dental Hygienist- dental hygiene degree and licensure

Which of the dental public health competencies/roles directly relate to your position?

All AAPHD competencies relate to my position, along with all ADHA Professional Roles for the Dental Hygienist, and all ADEA competencies.

How are your program and position funded?

The program and position are grant and gift funded.

The program is funded by:

- American Dental Association Samuel Harris Fund, Catholic Healthcare West Foundation, Arizona Diamondbacks Baseball Team, City of Chandler

The position is funded by:

- National Children's Oral Health Foundation, Wal-Mart, SanTan Ford, Rotary Club

Describe other roles/opportunities you've had as a dental hygienist working in public health.

I am also employed as the Associate Director of Dentistry in the Community at A.T. Still University, Arizona School of Dentistry & Oral Health where I am responsible for developing

community projects and participation opportunities with a specific dental school course/module that spans three years. I work with 110 students and provide oversight for 25–30 community-based projects. I serve as a resource and assist them in assessing community needs, planning and implementing community events and interventions, and evaluating project outcomes. I am responsible for student assessment.

Additionally, I have been a dental hygiene clinician for the Maricopa County Sealant Program in Arizona and the Central Arizona Shelter Services Dental Clinic for homeless in Phoenix, Arizona.

What factors contributed to your decision to work in public health?

There are three factors that contributed to my decision to work in public health.

- A passion for serving contributed to my decision to work in public health. I needed to give back and contribute to my community by providing care to those who are less fortunate. This was an innate feeling that was nurtured by the influence of my mother.
- Champaign/Urbana County Sealant Program in Illinois provided me, as a student, the opportunity to observe a recent dental hygiene graduate working in the program. I thought if she can do it, I can too!
- Excellent mentors, role models and leaders in the profession, such as Kneka Smith, MPH, RDH, Wayne Cottam, DMD, MS, Linda Garcia, MS, RDH, and Lynnette Martin, RDH, AP.

Please describe your career path – where you started and how you ended up in your current position.

Upon graduation from dental hygiene school, I felt a strong sense of gratitude for being blessed to develop the skills to provide preventive dental services. I began to seek opportunities where I could give back and serve underserved populations on my days off from private practice. Once or twice a week I worked as a part-time clinician for the Maricopa County Sealant Program applying sealants in elementary schools on underserved 2nd and 6th graders. During this time I also became involved in teaching dental hygiene at Phoenix College in Phoenix, Arizona. I enjoyed the field of education greatly and was able to build relationships with wonderful mentors, role models and leaders. I enjoyed working in public health and education so immensely that I just knew I had to get more involved.

In the spring of 2004, Arizona Governor Janet Napolitano signed HB 2194 into law, which created a new opportunity for children to access preventive dental services. This law allows dentists and dental hygienists to work in collaboration to increase access to preventive dental services through a non-traditional model called an Affiliated Practice Relationship (APR). In an APR, dental hygienists can provide preventive oral health services (exams, radiographs, fluoride, prophylaxis, sealants, etc.) to qualified children in a variety of community-based health and educational settings without a prior examination by a dentist. This legislation inspired me to do more to serve the underserved. I fulfilled the education and contract requirements to become an affiliated practice dental hygienist. Then I presented a business plan to create a preventive dental clinic in an underserved Chandler elementary school to Chandler Regional Hospital's Community Outreach department.

Simultaneously, a job opportunity to work with dental students creating community outreach projects at A.T. Still University's Arizona School of Dentistry & Oral Health, a university with a strong emphasis in public health, became available. Though these job opportunities were a big transition from private practice, I was eager to focus my career on public health.

continued

Please describe anything else you feel would be important if you were talking to a dental hygiene student considering a career in public health.

I find that a career in public health is more rewarding than private practice. In public health, I am able to impact the lives of many more people. Additionally, my clients in public health are typically very grateful and appreciative. It is exciting to create and implement dental programs that affect populations in a positive manner. The experiences are unique and the journey is worthwhile. It takes passion and commitment, but this comes naturally when you love what you do. In everything, do what you love and love what you do.

Identify the greatest challenges you find in your public health role(s).

The greatest challenge that I have in my public health role is navigating corporate structures. I prefer to work in an environment that promotes autonomy and efficiency. Corporate policies can be restrictive and make it difficult to maintain an autonomous and efficient work environment. However, I have found that if you surround yourself with good people and effective leaders the corporate structure is manageable.

Describe the greatest challenges to public health that you anticipate for the next decade.

The greatest challenges to public health that I anticipate in the next decade are the increase in demand for public health programs, decrease in funding for public health programs and insufficient workforce to meet the demand and challenges. Dentistry needs to take an active role in promoting careers in dental public health, supporting non-traditional delivery models and educating dental professions to meet the demand for public health programs.

When considering volunteering with an organization, it is advisable to investigate its philosophical background, history, and expectations and also the cost to the volunteer. Often, travel costs are borne by the volunteer; however, the rewards are traditionally much greater than the cost!

Many communities have nursing homes, health fairs, free clinics, homeless shelters, and other sites that welcome the participation and input from oral health providers. This is a way to network with other health care providers in your local area.

EDUCATION OPPORTUNITIES

There are many opportunities to obtain advanced education in dental public health, with many more appearing on the Internet. It is important to use your assessment and critical evaluation skills to determine which opportunity for advancement is of the type and quality to lead you successfully down your chosen path. Talking to public health professionals can also aid you in this endeavor.

Available programs include limited or full coursework online, programs that can be pursued while working by attending intensive courses at a university, or programs that require full-time attendance on campus for the specific time it takes to complete the degree or certificate. There is certainly great flexibility in pursuing advanced education in public health. Some resources to begin your search are listed in the resource section of this chapter.

Summary

There are many varied opportunities for dental hygienists to contribute to the public's oral health, build a satisfying career in public health, and become an essential piece of the puzzle. The role models in this chapter exemplify this. Many entry-level and clinical positions in public health settings do not require advanced education; however, positions for career dental public health

professionals with higher authority and responsibility may require advanced training in dental public health. Whichever path leads to a public health career, or whether you use volunteerism to improve the oral health of the community, it is a rewarding and satisfying experience.

Learning Activities

1. Interview a public health dental hygienist about their job (e.g., qualifications, responsibilities, funding, percentage of time in different activities, and competencies and skills needed). This can be done online by e-mail if the public health professional is not local.
2. Shadow a public health professional for a day.
3. Compare and contrast the skills needed for a public health dental hygienist and a private practice dental hygienist.
4. Compare and contrast the different sets of competencies/skills developed for public health practitioners (i.e., Council on Linkages, American Board of Dental Public Health, ADEA, Canadian Association of Public Health Dentistry). See Resources at end of chapter.
5. Shadow or work on a mobile dental van for a day.
6. Visit a foreign country with a dental team.
7. Investigate a local dental public health agency or program to identify its funding sources.

Resources

Competency Documents:

See References #1-5

Educational Opportunities:

<http://www.pathwaystopublichealth.org>
<http://www.sph.umich.edu>
http://kdheks.gov/ohi/download/UMKC_ONLINE_COURSE.pdf
<http://www.nwtc.edu/FLO/certificates.htm>
http://www.atsu.edu/shm/online_programs/public_health/index.htm
http://www.sph.unc.edu/distance/degrees_and_certificates.html

Dental hygiene programs:

http://www.adha.org/careerinfo/dir_education.htm
 degree completion
 related master's degrees
 distance learning

Schools of public health:

<http://www.asph.org>

Volunteer Opportunities:

National and International
<http://www.ada.org> (volunteer)
 Mercy Ships International
<http://www.mercyships.org>
 Medical Teams International
<http://www.medicalteams.org>
 American Cancer Society
<http://www.cancer.org>
 National Smokeless Tobacco Education Program (NSTEP)
<http://www.nstep.org>
 Prevent Abuse and Neglect through Dental Awareness (P.A.N.D.A.)
<http://www.deltadentalks.com/DDKS/DentistsPANDA.aspx?DViewDentistsPANDAProgram>
 Special Olympics Special Smiles (SOSS)
<http://www.specialolympics.org>
 Give Kids a Smile (GKAS)
<http://www.ada.org/public/events/gkas.asp>
 International Federation of Dental Hygienists (IFDH)
<http://www.ifdh.org/workabroad/>
 World Health Organization
<http://www.who.int>

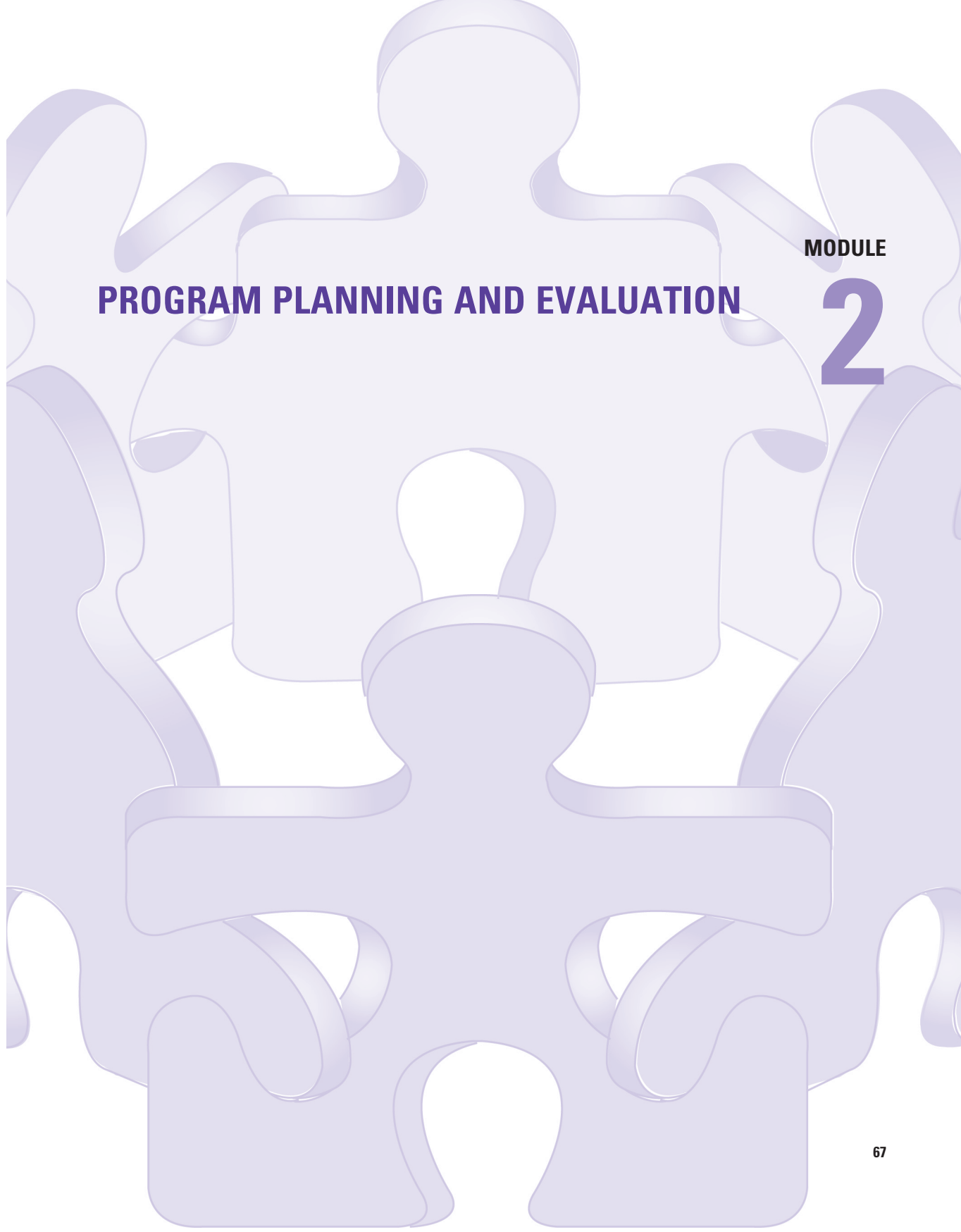
Review Questions

1. The primary difference between public health practice and private practice is:
 - a. assessing the patient's/client's oral health needs.
 - b. planning an appropriate intervention.
 - c. implementing a treatment plan.
 - d. evaluating outcomes of an intervention.
 - e. the community is the client, rather than an individual.

2. Which organization has developed competency statements specifically for the newly graduated dental hygienist?
 - a. American Association of Public Health Dentistry
 - b. American Dental Education Association
 - c. American Dental Hygienists' Association
 - d. American Board of Dental Public Health
 - e. Council on Linkages Between Academia and Public Health Practice
3. What is the primary department of the federal government that oversees public health activities at the national level?
 - a. American Association of Public Health Dentistry
 - b. Association of State and Territorial Dental Directors
 - c. United States Public Health Service
 - d. Department of Health and Human Services
 - e. Commissioned Corps of the United States Public Health Service
4. In what roles might a public health dental hygienist participate in professionally?
 - a. educator
 - b. administrator
 - c. advocate
 - d. researcher
 - e. all of the above

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MODULE

PROGRAM PLANNING AND EVALUATION

2

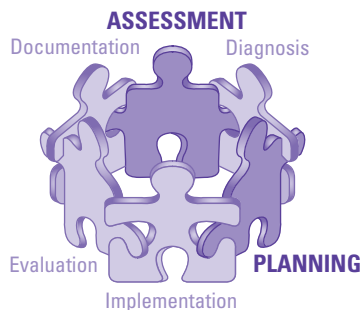
Effective Community Programs

5

Objectives

After studying this chapter and completing the study questions and activities, the learner will be able to:

- Compare and contrast community program development with individual patient care.
- Describe the crucial aspects of effective program development.
- Identify potential community partners for addressing local oral health issues.



KEY TERMS

ASTDD Seven-Step Model
Common risk factors
Cost-effective
Efficacious
Healthy People 2010 Toolkit
Leveraging resources
Logic model

**Mobilizing for Action through
Planning and Partnerships
(MAPP)**
Needs
Partners
Partnerships
Planning models

Precede-Proceed Model
Resources
Stakeholders
Target group
Targeting

See Appendix 3 for the ADEA competencies addressed in this chapter.¹

Introduction

An expert dental public health professional is able to assess oral health needs and then develop, implement, and evaluate programs aimed to improve the oral health of target populations. This chapter describes the criteria for effective program development and highlights the similarities and differences between the process of individual patient care and community program development. Several planning models are available to guide the development process; selected models are described.

THE ROLE OF PROGRAM DEVELOPMENT IN PUBLIC HEALTH

Program development is the heart of dental public health. It is integral to effectiveness at the local,

state, regional, national, and international levels. Program development incorporates the three core functions of public health—assessment, policy development, and assurance. Many of the essential public health services described in Chapter 1 are used in the development process including

- monitoring health status to identify and solve community health problems.
- diagnosing and investigating health problems and hazards in the community.
- mobilizing community **partnerships** and actions to identify and solve health problems.
- evaluating effectiveness, accessibility, and quality of personal and population-based health services.
- developing policies and plans that support individual and community health efforts.
- researching for new insights and innovative solutions to health problems.

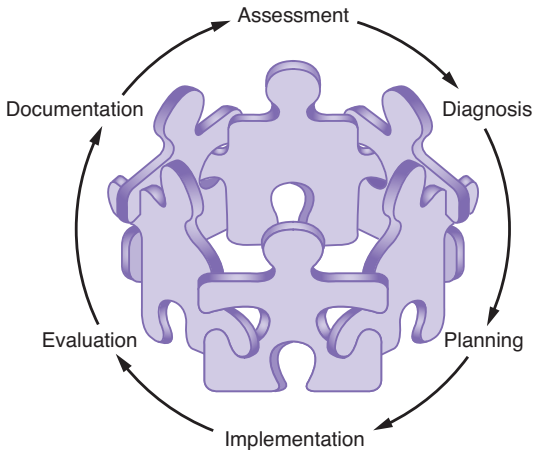


FIGURE 5-1 Program development cycle. Assessment, diagnosis, planning, implementation, evaluation, and documentation.

“Public health dental hygienists must appreciate their role as health professionals at the local, state, and national levels. This role requires a dental hygienist to assess, diagnose, plan, implement, evaluate, and document programs and activities to benefit the general population. In this role, a dental hygienist must be prepared to influence others to facilitate access to care and services.”²

The program development cycle, as shown in Figure 5-1, is a continuous loop. Assessment occurs first, followed by diagnosis, planning, implementation, evaluation, and documentation. Information gleaned from the evaluation feeds back to the planning cycle. Each step builds to the next, with the evaluation leading to program improvements. This process is integral to all public health planning models, just as it is to individual patient care.

COMPARISON OF COMMUNITY PROGRAM DEVELOPMENT TO DENTAL HYGIENE PROCESS OF CARE

Community program development in public health parallels the dental hygiene process of care, with which you are already familiar. However, in community-based programs, a **target group** is the patient, the “big picture” is even bigger, and the process is more complex

(Table 5-1). Just as it is important to involve the patient in all parts of their individual care, it is important to involve the community in every step of the program development process.

An oral health provider first collects information to assess the needs of the patient. **Needs** can be defined as those things that are lacking but that are necessary for people to be in a healthy state. Similarly, the public health professional collects or uses information to identify the needs of a community or group. In both the individual patient and community levels, the assessment of needs leads to a diagnosis. The patient’s values, priorities, financial ability, health status, and many other factors are considered in prioritizing the needs and then developing a treatment plan using evidenced-based methods to address and alleviate the patient’s needs. In public health, **resources**, community priorities, politics, the environment, and other factors are considered in developing a plan to alleviate the identified needs also using evidence-based methods. In private practice, an individual’s treatment is implemented, the results are reevaluated periodically, and the patient is retreated as necessary to improve and maintain health. Public health programs are implemented, monitored, evaluated, and adapted to improve and maintain the health of the community. In both settings, careful planning ensures that the right interventions are provided effectively and efficiently. Evaluation provides accountability to those with a vested interest and guides effective individual patient care, as well as program improvements at the community level. Finally, the individual patient care provider documents in a patient’s chart and shares the information with patients, other providers, and third-party payers. Similarly, the public health provider documents the results of programs to share with interested parties, government agencies, and funding sources.³

CRITERIA FOR EFFECTIVE COMMUNITY PROGRAM DEVELOPMENT

Programs must meet several criteria to be effective in improving the public’s health. They must be designed to meet a community recognized

TABLE 5-1 COMPARISON OF INDIVIDUAL PATIENT CARE PROCESS TO COMMUNITY PROGRAM DEVELOPMENT

INDIVIDUAL PATIENT CARE PROCESS	COMMUNITY PROGRAM DEVELOPMENT
Assessment • dental and health history • record vital signs • intraoral and extraoral examination • periodontal evaluation • hard tissue evaluation • oral cancer/soft tissue screening • oral hygiene assessment • expose, process, and interpret dental radiographs • assessment of related factors (social, behavioral, psychological, cultural, economic) • consultation with health care providers as indicated Diagnosis • caries status • periodontal status • dental hygiene diagnosis • other oral needs Planning • determine services to be rendered (caries-preventive, periodontal therapy, restorative, esthetic, referral for specialty services, nutrition or tobacco counseling, education on association between systemic and oral disease) • select appropriate provider to deliver care (dental hygienist, dental therapist, assistant, general dentist, or specialist) • obtain informed consent Implementation • provide patient care (scaling, root planing, sealants, fluoride, tobacco counseling, educational materials) Evaluation • posttreatment oral health • compare pretreatment and posttreatment data • appropriateness of care • patient satisfaction • determine next phase of treatment Documentation • provide thorough chart entries • inform patient • report to other health professionals • report to third-party payers	Assessment • community oral health needs (secondary and primary data if necessary) • demographics • related factors (social, cultural, economic, political, environmental, common risk factors, stakeholders) • community resources (people power, funding, services available, possible partnerships) • consultation with other public health professionals and stakeholders as indicated Diagnosis • analyze and prioritize community needs • include partners, stakeholders, and advisory group Planning • determine priorities and alternatives • gather resources • develop goals and objectives • select appropriate activities and interventions to meet goals • select appropriate personnel (dentist, dental hygienist/therapist, assistant, teachers, health care personnel, social workers, health educators, community health workers, WIC counselors) • obtain community acceptance Implementation • provide intervention (clinical services, education, legislation, advocacy) • formative/process evaluation Evaluation • attainment of goals and objectives • cost-effectiveness of program • appropriateness of activities • community satisfaction • summative/outcome evaluation Documentation • report to funding agencies • report to stakeholders (program participants, decision makers, partners, interested parties)

need, based on sufficient community resources, cost-effective, targeted toward identified needs, and accepted by the community. A proactive

approach should be used rather than a reactive approach, and a common risk factor approach should be used as much as possible.

Community Recognized Need

A problem serious enough to merit resources and program planning efforts to alleviate it should meet the definition of a public health problem as presented in Chapter 1. The community must consider problems serious and relevant. “Public health professionals and policy makers must understand that oral health is essential to general health and well-being at every stage of life.”⁴ Ownership and commitment to the success of the program are especially important. For example, if parents view high tooth decay rates in children as serious enough to interfere with their health, wellness, and ability to learn, they will be more likely to endorse a school-based fluoride mouth rinse program.

Sufficient Community Resources

Chapter 2 introduced the concept “mobilizing assets through coalition building” and the trend is emphasized again here. Sufficient resources, including people power, money, time, facilities, supplies, equipment, and legislative authority, must be available to support the start-up and continuation of a program. To start a program without the necessary resources is potentially worse than doing nothing at all; the recognized unmet needs could result in frustration and mistrust. Most funding agencies are interested in knowing how a program will sustain itself after initial pilot funding. Public/private partnerships and volunteerism are important mechanisms to sustain programs. Although it can be a challenge to obtain funding for new and innovative programs, it can be much more difficult to obtain funding for an existing program.

Most programs need various resources, including people (time, skills, talent), communication (printing, postage, telephones, copying), equipment (dental equipment, furniture, computers), supplies (sealant material, disposables, fluoride, pencils, paper, food), space (meeting places, offices, storage), transportation (airplanes, buses, cars), and special or miscellaneous needs (child care, security).⁵ A community’s assets can potentially support a program for a long time. Service

clubs, insurance companies, hospital foundations, and dental organizations may serve as potential long-term funding sources. Service clubs, parents, and dental professionals may provide volunteer support; car dealers may volunteer the use of vehicles; and dental supply companies may donate supplies.

A change in policy may also help program sustainability. For example, if a state’s practice act does not allow dental hygienists to be directly reimbursed for services, the practice act could be changed. Or, possibly a nonprofit community health center or county clinic could serve as the “provider” to be reimbursed by Medicaid or insurance to cover the dental hygienist’s services.

Oral health programs frequently function in isolation from other public health efforts although multiple programs may be striving to achieve the same results while competing for limited funds. The concept of **leveraging resources** is emerging in response to the difficulty of trying to provide programs dependent on limited government funds. A program’s potential can be greatly expanded by combining resources with other programs, working in community coalitions or with **partners** to accomplish mutual goals. For example, oral hygiene education can be offered by Women, Infants, and Children (WIC) counselors, oral health assessments and fluoride varnish applications can be incorporated into well-baby visits or immunization appointments, and comprehensive nutrition programs can include oral health applications. Further, insurance companies may be interested in reducing treatment costs by working with local or state health departments to cosponsor education and prevention programs.

Cost-Effectiveness

Cost-effective programs deliver enough benefit to justify their cost. Community-wide water fluoridation is considered one of the most cost-effective preventive measures available, costing approximately 50 times less than restoring teeth. It may seem obvious that a program that costs less but has high impact is more desirable to

sponsors than a program that costs more with the same or lower impact. However, less effective programs may be more popular. Because of local political climates, water fluoridation may be less popular than school fluoride mouth rinse programs even though it is more effective.

Because of recent research linking oral health with general health, the benefits of health promoting interventions can be compared with reductions in the cost of treating diabetes, heart disease, and low-birth-weight infants. Many oral health programs may be cost-effective based solely on their reduction in systemic diseases and related economic burden.

Targeted Interventions

Oral health promotion programs must match current needs and health priorities and use resources wisely by **targeting** efforts toward at-risk populations.⁶ This means that high-priority populations are targeted with appropriate **efficacious** interventions. Interventions should be science-based and proven appropriate for individuals and communities.⁴ The Guide to Community Preventive Services and the Guide to Clinical Preventive Services provide criteria and guidance for evaluating scientific literature and promoting effective interventions.⁷

As an example, if a program goal were to reduce dental caries in children ages 6 to 12 years, it would not be enough to just teach a class on toothbrushing methods at every school in a community. Multiple age-appropriate interventions might be recommended, including fluoride, oral hygiene measures, school-based sealants, and replacement of soda and candy with healthy snacks in vending machines.

Preventive interventions also should be culturally appropriate or developed in consideration of language, health beliefs, dietary practices, child rearing practices, and other factors that influence health practices. Additionally, assessments showing that low-income minority children are disproportionately affected means that those schools in low-income and/or ethnic neighborhoods would receive priority over schools in mid- to high-income neighborhoods.

Community Acceptance

Stakeholders' acceptance is crucial to the success of programs. Stakeholders are people who have the potential to be affected by a program and could include community and organization decision makers, sponsors, dental health professionals, and targeted end users (community members and taxpayers).⁸ Broad representation should be included during initial program development and continued during all stages. It is not safe to assume that a program's ability to improve health will automatically lead to various parties' commitment, support, and acceptance. However, groups are motivated by the recognition that programs will have a direct benefit to them. For example, policy makers may be motivated by the potential to save taxpayer money and gain voter approval. Dental/dental hygiene school faculty may be interested in providing students with quality community experiences that enhance education and look favorable to credentialing organizations.⁹

Proactive Approach

Health promoting interventions are most effective if they strategically predict, plan, and prevent potential crisis rather than react to problems. For example, it would be preferable to promote the use of mouth guards, helmets, and seat belts than to spend valuable resources on the treatment of preventable oral injuries.

Common Risk Factors

Factors that increase oral disease risk often raise the risk for other illnesses as well. Smoking increases periodontal disease and oral cancer risk and also increases the risk for the development of other cancers, respiratory disease, heart disease, and many other disorders. Frequent high-sucrose snacking often leads to dental caries and is linked to obesity and poor diabetes control. Programs designed to address these **common risk factors** such as tobacco cessation, diet counseling, and health education can effectively reduce the risk for many diseases and at the same time use funds efficiently in a fiscally

responsible way hopefully leading to more sustainable programs. The Coordinated School Health Program (CSHP), a model used by the Centers for Disease Control and Prevention, many state agencies and school districts, is an example of a national effort designed to use an integrated common risk factor approach. This approach maximizes the use of resources and avoids unnecessary duplication of efforts. Oral health can be integrated into each of the eight components of the CSHP model.¹⁰

In European countries, integration of oral health with general health programs is more common than in the United States.¹¹ A common risk factor approach makes sense, as it shares resources and improves effectiveness.¹² Tobacco, unhealthy diet choices, and poor oral hygiene are behaviors that contribute to many diseases. Through general health programs, oral health can be improved, coinciding with diabetes control, reduced heart disease, and improved birth outcomes.

Seven criteria for effective program development have been described. If any criteria are missing, the initial program may be adapted to improve weak areas. Suppose a plan to decrease early childhood caries is proposed and that plan includes assessment, education, and placement of fluoride varnish. Initial development reveals that there are not enough oral care providers or a state practice act does not support an activity such as the application of fluoride varnish by a dental hygienist. This reflects a lack of resources. A program, using the common risk factor approach, could then train nurses, physician assistants, and nurse practitioners to include an oral assessment and fluoride varnish application during well-baby visits, increasing the actual available assets or resources needed to carry out a program. The program could also, at the same time, advocate for changes in the dental practice act to provide more flexibility.

PLANNING MODELS

Planning models can be thought of as structured guides or tools that are used when developing community programs. There are several

planning models used by oral health programs and general health programs. Five selected models will be illustrated, followed by a discussion of their similarities and differences. These models include Assessing Oral Health Needs: Association of State and Territorial Dental Directors' (ASTDD) Seven-Step Model, logic models, Healthy People 2010 Toolkit, Precede-Proceed, and Mobilizing for Action through Planning and Partnerships.

Assessing Oral Health Needs: ASTDD Seven-Step Model

Assessing Oral Health Needs: ASTDD Seven-Step Model is a needs assessment tool that can be accessed through the Association of State and Territorial Dental Directors' web site. It is used by many states, although many modify it to meet their needs. It provides a thorough systematic approach to gathering information for program planning. Figure 5-2 illustrates the seven steps involved.⁶

Logic Models

A **logic model** is a concise way to show how a program is designed and will make a difference for a program's participants and a community. It shows the relationship between the program's ultimate aim and the strategies and activities used to accomplish it, together with an outline of how progress will be measured along the way.¹³ Displayed graphically, it is customized according to defined health issues and identified risk factors.¹⁴ Figure 5-3 illustrates an example of a logic model.

Healthy People 2010 Toolkit

Healthy People 2010 Toolkit provides guidance, technical tools, and resources to help states, territories, and tribes develop and promote successful, state-specific Healthy People 2010 plans. Although Healthy People 2020 is in the developing stages, the principles behind Healthy People 2010 continue to be helpful as a resource for planning activities until Healthy People

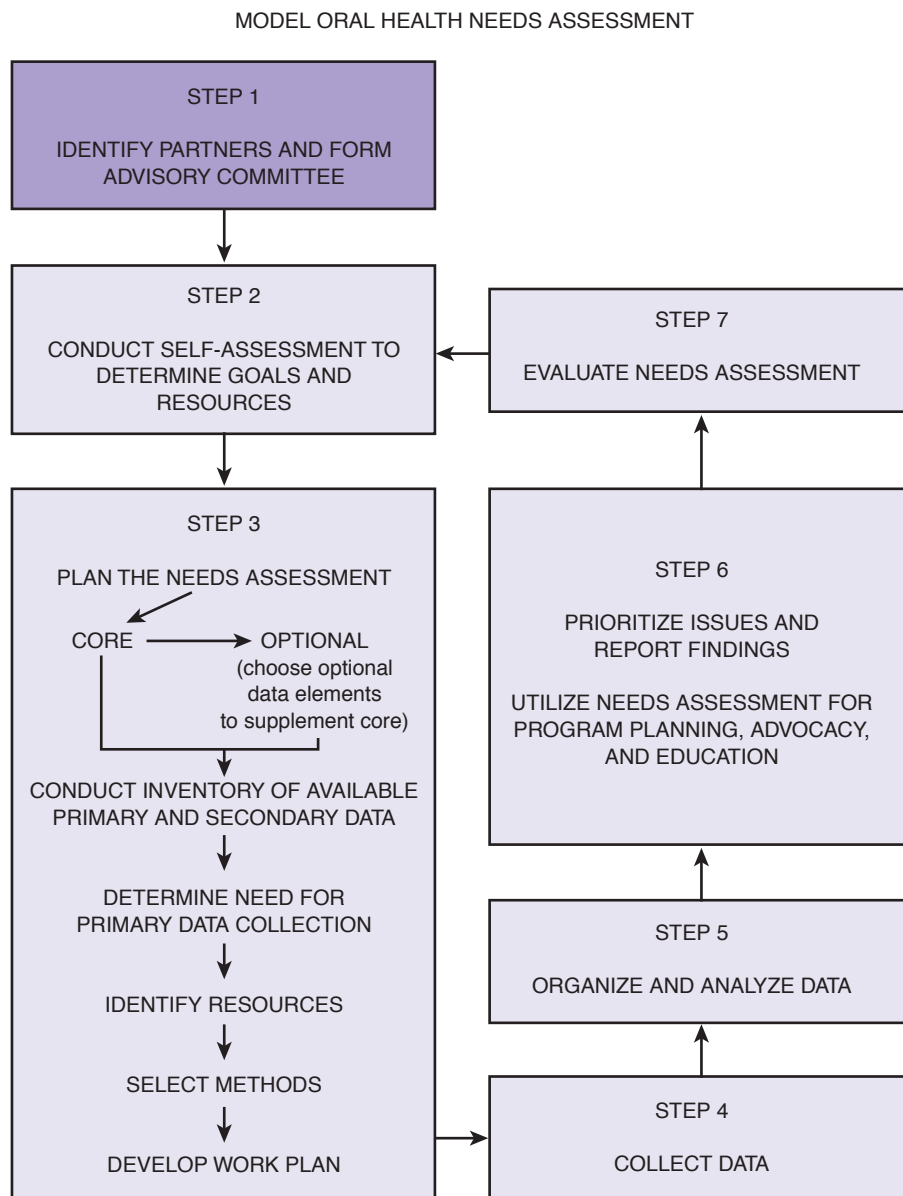


FIGURE 5-2 Seven-Step Needs Assessment Model. From Assessing Oral Health Needs: ASTDD Seven-Step Model (1995). Available at: <http://www.astdd.org>. Accessed July 2008.

2020 takes effect. Activities related to individual patient care in the Dental Hygiene Process of Care Model, such as providing sealants, help in the achievement of these overarching goals. The Tool Kit is available in a Web-based version,¹⁵ and is organized around seven major action areas

derived from national Healthy People initiatives. These areas are as follows:

- Building the foundation: leadership and structure
- Identifying and securing resources

Example Logic Model

Program Goal: To improve the oral health of low-income children who receive primary care in a community health center

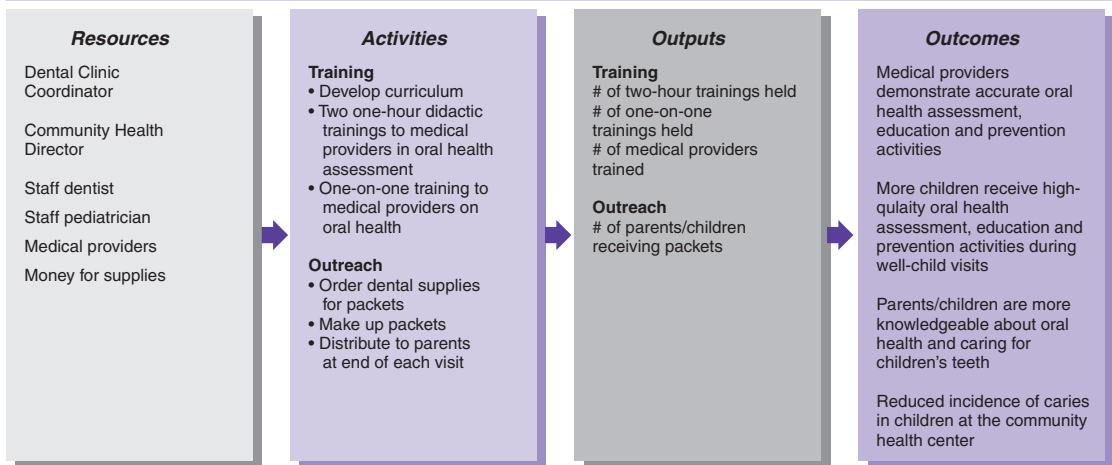


FIGURE 5-3 Example of logic model. Reprinted with permission from Karen Horsch, Consultant, Endowment for Health. Using Logic Models for Program Planning and Evaluation. 2004. Available at: <http://www.nhhealthpolicyinstitute.unh.edu/ec/#04>. Accessed March 2009.

- Identifying and engaging community partners
- Setting health priorities and establishing objectives
- Obtaining baseline measures, setting targets, and measuring progress
- Managing and sustaining the process
- Communicating health goals and objectives.

Precede-Proceed Model

Dr. Lawrence W. Green and colleagues developed the **Precede-Proceed Model** of health promotion program planning illustrated in Figure 5-4. The goals of the model are to “explain health-related behaviors and to design and evaluate the interventions designed to influence both the behaviors and the living conditions that influence them and their sequelae.” It is founded on many disciplines and emphasizes that (i) multiple factors influence health and health risks; therefore, (ii) multidimensional or multisectorial efforts are needed. Individual dental provider efforts included in the dental hygiene process of care would be included.

This evidence-based model has been used to plan various health education programs.¹⁶ A more in-depth example of its use is described in Chapter 9.

Mobilizing for Action through Planning and Partnerships

Mobilizing for Action through Planning and Partnerships (MAPP) illustrated in Figure 5-5 is a community-wide strategic planning tool for improving community health that builds on Healthy Communities 2000: Model Standards. It emphasizes community ownership and community-driven initiatives. This model includes phases that start with Organizing for Success and Partnership Development and follows with Visioning, Assessments, Identifying Strategic Issues, Formulating Goals and Strategies, and an Action Plan. Key content areas drive the process. Detailed information, guidance, tools, and vignettes can be found about the model from the National Association of City and County Health Officials.¹⁷

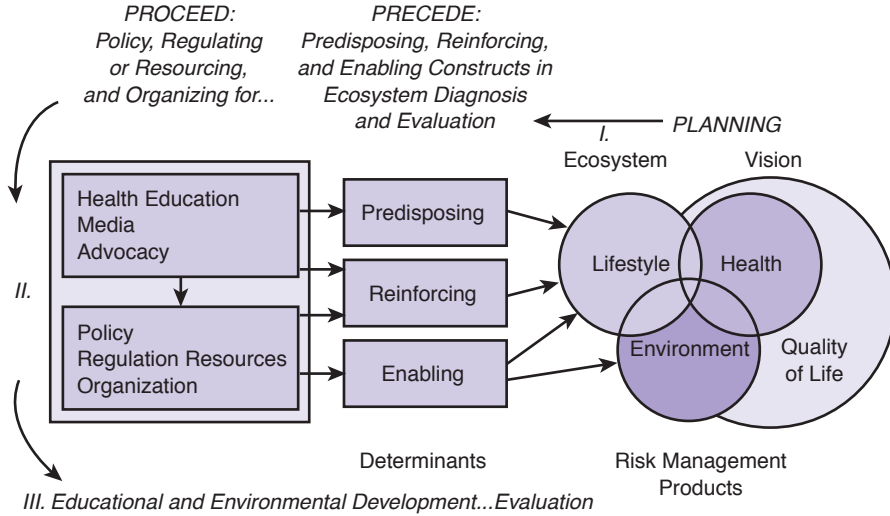


FIGURE 5-4 Precede-Proceed Model of health promotion program planning. Reproduced with permission from Green LW. *Health Program Planning: An Educational and Ecological Approach*. 4th ed. McGraw-Hill, 2004.¹⁶

Comparison of Models

All of the models provide useful insight into the stages and framework involved in the community program development process. Commonalities exist among them. In some form, all of the models use the steps of assessment, diagnosis, planning, implementation, evaluation, and documentation. Older models can be criticized for not considering the sociocultural, political, and environmental context of health or the lack of community involvement in the process.¹⁸

Some planners feel that Greene's Precede-Proceed Model is highly theoretical and cumbersome. ASTDD's Seven-Step Model has proved helpful in planning and evaluating assessments but not for program implementation and evaluation stages. In addition, professionals from other health disciplines are not familiar with this model, and its use may encourage the perception that dental public health practice is isolated from other public health programs. MAPP stresses community capacity. The strength of the logic model is its ease of understanding, use, and customization. The advantages and

disadvantages of selected models are outlined in Table 5-2.

No single model may be sufficient for all situations. Models are continuously being adapted as new factors arise that influence programs. Elements of different models may be combined to apply to a new situation or need.

COMMUNITY PARTNERS

It is vital to involve many community partners through coalitions and collaborative approaches. Performance is optimized through shared or leveraged resources and responsibility.¹⁹ Partners or stakeholders can be involved as advisory groups, key decision makers, or working groups. Their involvement increases their acceptance of the program. Broad community representation should be sought and can include members from the groups listed in Box 5-1.¹⁹

The smart planner includes all parties throughout the program development process, from assessing the needs of the community through documentation, in a celebration of successes. It is

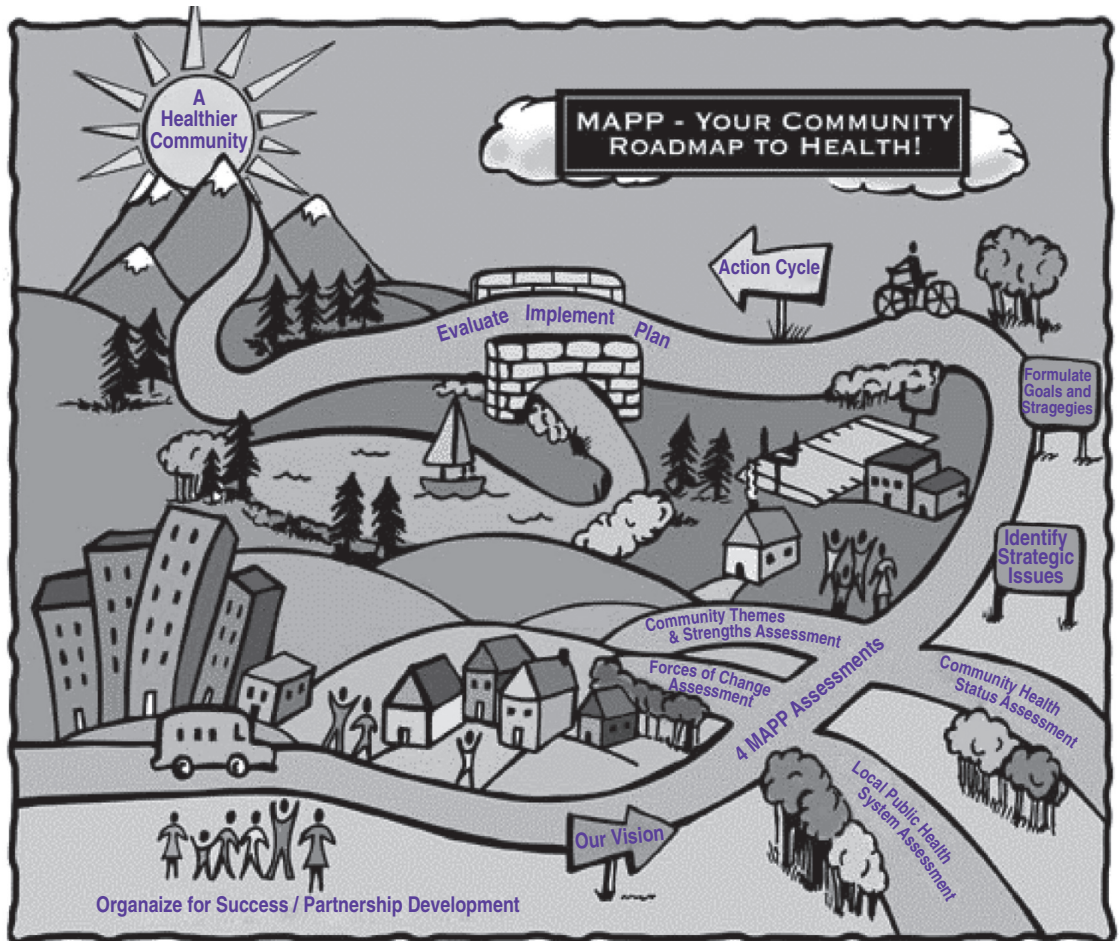


FIGURE 5-5 MAPP (Mobilizing for Action through Planning and Partnerships) Your Community Roadmap to Health. In this illustrated “community roadmap,” the MAPP process is shown moving along a road that leads to a “healthier community.” Available at: <http://www.naccho.org>.¹⁷

important not to overlook the roles and contributions of every individual and group. Presentations and certificates of appreciation recognize each group’s contribution to sustain excitement for the shared process.¹⁷

Summary

The activities involved in public health program development parallel the assessment, diagnosis, planning, implementation, evaluation, and docu-

mentation activities of individual patient care. In the same way that a dental provider assesses a patient’s needs prior to planning and implementing care and then evaluates the outcomes, a public health planner must also have a guiding process. It is helpful to use a standard planning approach, as do the models presented in this chapter. All of the models have elements that are useful, and the learner should recognize and have a basic understanding of different models and be prepared to contribute to the program

TABLE 5-2 COMPARISON OF PLANNING MODELS

MODEL	PURPOSE	ADVANTAGE	DISADVANTAGE
Precede-Proceed	Plan health education programs based on analysis of multiple health and risk factors	• Familiar to many professionals	• Cumbersome • Highly theoretical
MAPP	Strategic community-wide planning tool	• Comprehensive • Emphasizes community involvement	• Requires numerous resources
Healthy People 2010 Toolkit	Helps communities meet Healthy People Objectives	• Current • Available on the Internet	• Cumbersome for small programs
Assessing Oral Health Needs: ASTDD Seven-Step Model	Plan assessments	• Available on the Internet	• Requires using additional sources for program development pieces • Unfamiliar to those outside of the oral health field
Logic Model	Custom-designed plan to address various health issues and identified risk factors	• Easy to use and understand	• Assumes user has previous knowledge



BOX 5-1 Potential Community Partners

- Professional oral health organizations
- Oral health providers
- State or local oral health departments
- State maternal and child health programs
- WIC Program
- Medicaid program
- Early and periodic screening, diagnosis, and treatment
- Public and private school systems, including dental and dental hygiene schools
- Advocacy health organizations (e.g., Children's Defense Fund)
- Other health professional associations and their members
- Organizations advocating for special populations
- Civic groups, trade unions, and local businesses
- Consumer groups
- Mass media
- Decision makers and community leadership
- Dental and related industries
- Insurance agencies and companies
- Athletic organizations
- Faith organizations

From Cohen LK. Promoting oral health: guidelines for dental associations. *Int Dent J*. 1990;40(2):79–102.¹⁹

development process. Programs are much more effective when planning is accomplished with the input and acceptance of the community and when there are sufficient resources to conduct a program. Effective programs use appropriate targeted interventions, have recognized benefit to all stakeholders and, in today's world, may use the common risk factor approach and leverage resources to optimize their effectiveness.

Learning Activities

1. Refer to the list of essential public health services in Chapter 1. Peruse the local newspaper for articles about local public health efforts. Identify how essential public health services are or could be applied in the local public health efforts.
2. Contact a local community health center or nonprofit organization. Request a list of advisory board members. Identify how the program may benefit or be of interest to each party.
3. Interview the director of a local service program, asking questions related to the seven criteria for effectiveness to see if each is met by the program.
4. Identify a public health initiative and identify key stakeholders.
5. Identify a potential local public health problem. Choose one of the models and describe how it would apply toward addressing it.

Resources

Program Planning web sites:

The Precede-Proceed Model of Health Promotion: <http://lgreen.net/precede.htm>

Healthy People 2010 Tool Kit: <http://www.healthypeople.gov/state/toolkit/>

Healthy People 2020: The Road Ahead: <http://www.healthypeople.gov/hp2020>

Association of State and Territorial Dental Directors (ASTDD): <http://www.astdd.org>

Centers for Disease Control and Prevention (CDC): <http://www.cdc.gov/eval/resources.htm>

W.K. Kellogg Logic Model Development Guide: <http://www.wkkf.org/Pubs/Tools/Evaluation/Pub3669.pdf>

Online Course: developing logic models and evaluation plans: www1.uwex.edu/ces/lmcourse

Logic Model Tools: <http://www.cdc.gov/eval/resources.htm#logic%20model>

Review Questions

1. All of the following are required for effective program planning EXCEPT:
 - a. sufficient time and resources.
 - b. prompt reaction to a crisis.
 - c. community recognition of a need.
 - d. behavioral, cultural, environmental, and political influences addressed.
 - e. community input and ownership.
2. The most important consideration when creating effective public health programs is to:
 - a. have a Master's degree in public health.
 - b. discuss problems with key stakeholders.
 - c. increase the public's awareness.
 - d. get the community's input prior to planning programs.
 - e. hire a program evaluator.
3. The best time to get community input when developing dental public health programs is:
 - a. during the evaluation stage.
 - b. during implementation.
 - c. during needs assessment.
 - d. during the writing of the goals and objectives.
 - e. during the grant writing phase.
4. Determining the cost-effectiveness of a community dental program is most similar to what element of the individual patient care process?
 - a. Setting a patient payment plan
 - b. Obtaining the patient's informed consent
 - c. Evaluating the effectiveness of treatment
 - d. Documenting the results of treatment
 - e. Diagnosing treatment needs

5. Sufficient resources are necessary for effective programs. The creative planner will use which of the following methods to make the best use of resources?
 - a. Leveraging resources
 - b. Considering common risk factors
 - c. Working in coalitions
 - d. Developing partnerships
 - e. All of the above

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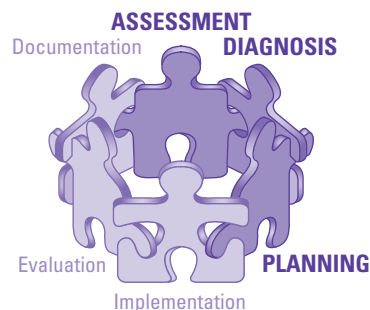
Planning for Community Programs

6

Objectives

After studying this chapter and completing the study questions and activities, the learner will be able to:

- List the types of data that should be included in a community assessment.
- Identify relevant data sources.
- Differentiate between primary and secondary data sources.
- Describe the parts of the program plan.
- Develop mission statements, goals, and objectives.
- Provide examples of interventions and activities.
- Develop a program time line.
- Develop a program budget.



KEY TERMS

Activities

Community needs assessment

Community profile

Cost–benefit ratio

Direct activities

Flow charts

Indirect activities

In-kind support

Interventions

Job descriptions

Mapping

Mission statement

Needs analysis

Organization diagram

Pilot test

Primary data

Program goals

Program objectives

Secondary data

Time line

Work statement

See Appendix 3 for the ADEA competencies addressed in this chapter.¹

Introduction

This chapter discusses the first three phases of the basic program development process described in Chapter 5, including assessment, diagnosis, and planning for community-based programs. Specific evaluation methods will be discussed in Chapter 7; however, it is important to consider evaluation and documentation strategies throughout development of the program plan. Each part is interrelated and integral to the success and effectiveness of programs. The methods for program development incorporate the common steps included in the various planning models presented in Chapter 5. The entry-level learner, who understands these steps, is prepared to contribute to the program development process.

It is important to include an advisory group in the program development process. The advisory group described in Chapter 5 can provide input into identifying relevant problems, considering alternative solutions, developing a plan for making effective and efficient use of resources, identifying resources necessary for implementation and evaluation and, finally, fostering ownership for the plan and commitment to its success.²

THE COMMUNITY NEEDS ASSESSMENT

The **community needs assessment** (Box 6-1) has several purposes. This step in program planning helps determine to what extent needs exist and compares their salience to other problems



BOX 6-1 The Community Needs Assessment

- Collection of Facts
- Identification of Needs
- Analysis of Needs
- Prioritization of Needs

and needs. The needs assessment phase includes the collection, analysis, and interpretation of information and is the foundation for effective program planning and successful program development. The planning models discussed in Chapter 5 illustrated various methods for the collection and organization of data.

Collecting Facts

The first step in needs assessment is to collect facts and information to build a community assessment or **community profile**. The information includes demographic data, knowledge, attitudes and practices, oral health status, and the impact of current oral health levels.

Demographic data help the planner understand the makeup of the community. This data may include information about age, gender, education, occupation, income, ethnicity/language, geographic area, length of residence, and school enrollment.

The collection of community knowledge, attitudes, and self-care practices leads to an understanding of the level and type of health promotion interventions that already exist or are lacking. Data may include the community's knowledge and attitudes and practices concerning oral health, such as the frequency and values regarding visits to oral health care providers; reasons and expectations for oral health services; knowledge about water fluoridation, plaque removal, use of fluoride regimens; frequency of consumption of sweets and other highly refined carbohydrates; tobacco and alcohol use; and use of orofacial protection.

Oral health status indicators for the community can be compared with state and national data. These may include the percentage of people with decay experience, percentage of untreated decay, percentage of children with sealants, percentage of adults who are edentulous, and the percentage of tobacco users.

The impact of current oral health levels is needed to understand the costs of disease and the potential benefit of programs. This data may include time lost from school and work and expenditures for dental services.^{2,3}

Facts about dental resources and existing programs are also included in a needs assessment. These may include number, type, and distribution of dental providers; number and type of low-cost clinics; and percentage and type of providers who accept Medicare/Medicaid patients. It is also helpful to collect data about barriers such as the percentage of people without dental insurance. Finally, information about the environment, including schools, water systems, transportation services, other health care facilities, and laws and regulations regarding oral health are also important. Working with other interested agencies and an advisory group of key leaders and stakeholders is invaluable to effectively identifying needs and community assets.

Information relating to the community may be readily available. Data that are already available are referred to as **secondary data**. In other situations, it is necessary to collect information directly by means of a survey or dental screening method. Data collected specifically for use in a program are referred to as **primary data**. The collection of secondary data, prior to collecting any primary data, will save time and money, depending on how well the data fit the information needs. For this reason, it is important to search for secondary data carefully and thoroughly. Table 6-1 lists the advantages and disadvantages of primary and secondary data.

There are many ways to collect useful secondary data. Sources may include federal, state, and local health agencies; other public health programs; and the state dental board. A research librarian can be tremendously helpful in this process. In addition, the Internet presents a useful

TABLE 6-1 COMPARISON OF PRIMARY AND SECONDARY DATA

TYPE OF DATA	TECHNIQUE/TYPE	ADVANTAGE	DISADVANTAGE
Primary	• Survey/questionnaire • Interview • Observation • Experiment	• Current information • Answers specific question • Known source	• Expensive • Time consuming
Secondary	• Computerized database • Bibliographic database • Numeric database	• Inexpensive • Readily available • Enhance existing data	• May not match needs • Definitions may not be useful • May be out of date • May be difficult to assess credibility

tool. Table 6-2 illustrates examples of Internet sites that contain secondary data.

Survey Methods

After an exhaustive search for secondary data, the planner can consider methods for collecting primary data. There are advantages and disadvantages of different types of measurement to consider before embarking on a survey, questionnaire, or screening. The type of information needed also determines the type of data collection that is necessary. Focus groups, surveys, and individual interviews can determine attitudes, knowledge, behaviors, and values. Oral health

status information, including oral hygiene, dental caries, and periodontal disease levels, requires a screening using a dental index with standardized methods and calibrated examiners. Chapter 12 addresses the dental indices useful for community health programs.

It may be useful to consult with experienced personnel, for example, the state department of health or a regional office of the U.S. Public Health Service. A statistician can help with sampling, recording methods, data analysis, and presentation of findings. Problems with questions can be identified and solved in advance by using a **pilot test**, which is a method of confirming the survey is usable, to determine if people interpret

TABLE 6-2 WEB SITES FOR SECONDARY DATA

TYPE OF DATA	WEB SITE
Federal data	http://www.fedstats.gov
Census data	http://www.census.gov
National opinion poll data	http://www.gallup.com
National Oral Health Surveillance System	http://www.cdc.gov/nohss/
National Center for Health Statistics	http://www.cdc.gov/nchs/
Bureau of Labor Statistics	http://www.bls.gov/
Healthy People Objectives	http://www.healthypeople.gov
Examples of state data	http://www.hs.state.az.us/ http://www.chawisconsin.org/oralhealth.htm http://apps.nccd.cdc.gov/synopses/ http://www.cdc.gov/OralHealth/data_systems/index.htm

TABLE 6-3 COMPARISON OF SURVEY METHODS

	MAIL	TELEPHONE	PERSONAL
Quantity of Data	Fair	Fair	Excellent
Control of Interviewer	Excellent	Fair	Good
Control of Sample	Poor	Excellent	Good
Speed	Poor	Excellent	Good
Flexibility	Poor	Good	Excellent
Response Rate	Poor	Fair	Good
Cost	Good	Fair	Poor

questions as intended, and to make sure that given answers include all possibilities. Finally, it helps to work out all of the “bugs.” For example, a survey is planned to assess Head Start parents’ knowledge, attitudes, and behaviors regarding oral health. A small group of Head Start parents from a different community could take the survey as the pilot test and offer feedback on misleading or unclear questions.

Table 6-3 shows a comparison of survey methods. The type of survey is determined by comparing the pros and cons of each and by considering the type of information needed. A random phone survey would be an appropriate way to assess the percentage of people who wanted water fluoridation. A personal open-ended interview may be the best choice to collect information about cultural patterns that impact disease. A mailed survey may be a good choice for collecting information about dental providers.

The Community Profile

A compilation of all primary and secondary information builds a factual picture of the community’s profile. The community profile will help the planner assess the feasibility of a program and help determine whether or not there are sufficient resources to provide it. A program is likely to fail if there are neither enough nor the right resources available. The community profile is a demographic description of a community, including the total population, number of households and size, age distribution, household

income, marital status, racial/ethnic composition, education, geographic boundaries, the political and economic atmosphere, and dental and medical resources.

Analyzing and Displaying Information

After primary and secondary data are collected, they are tabulated, organized, and interpreted to present an accurate and overall view. Complex data are easier to understand if presented graphically. Tables and charts should be simple and clear with matching formats (e.g., pie charts all in the same color scheme).

Mapping is a tool to identify trends, patterns, and opportunities. This technique, borrowed from the business world, uses geographical information systems to provide analysis and display of health-related data sets on maps. Relationships between variables can become easily apparent and intervention efforts can be targeted to areas where they are most needed. For example, dental disease indices can be combined with census and postal codes. This could illustrate clusters of such oral problems as injuries, oral cancer, or dental decay related to demographic or socioeconomic factors. It is also an effective way to identify mismatches between dental services and population needs.⁴

Prioritizing Needs

The **needs analysis** helps determine whether a problem is caused by a lack of service or a lack

of use of existing services. The planner wants to demonstrate that the problem takes priority over other concerns and that money spent solving the problem will save money in the long term. When setting priorities, it is important to consider the emergency nature of the problem, the number of people affected, the public's perception of its importance, the availability of resources, the degree to which the conditions can be prevented or controlled, and the availability and acceptance of effective technologies.² An advisory group can help determine how needs should be prioritized.

Epidemiologic indices can be used to demonstrate the prevalence of a problem. Local data can be compared with state and national data to emphasize how a local problem compares with the national average or a relevant marker. The severity of the problem and predicted consequences if the program does not exist can be strong motivators for acceptance. A hypothetical example: Supposing Orange County data screenings and surveys reveal a severe dental problem. Among Orange County 6 to 8 year olds, 49% have untreated dental decay compared with 37% in California and 39% in the United States. Orange County school nurses report that more children miss school as a result of dental problems than for any other health complaint. If this dental disease is not treated, the dental caries will progress and the children's learning and overall well-being will be affected. Their untreated dental disease will become more expensive to treat.

The success rates for similar programs may motivate communities to give increased priority for the program. An estimated **cost-benefit ratio** is also helpful. This is the difference between the cost of providing the program versus the cost of not providing the program. For example: water fluoridation is both cost-effective and cost saving. Although the exact cost-benefit ratio varies depending on the size of a community and method of fluoridating, the expense associated with providing fluoridated water is much less than the cost of restorations per person in a nonfluoridated community. An annual cost sav-

ings ranges from \$15.95 per person per year in a small community to \$18.62 per person per year in a larger community.⁵

Finally, support letters from stakeholders can be collected and included to demonstrate widespread recognition of the problem by many agencies and respected citizens or leaders in the community. These will be much easier to solicit if these stakeholders are involved from the beginning.

DEVELOPING THE PROGRAM

Program development begins with assessing needs, diagnosing and prioritizing the problem, and then drafting the mission statement, program goals, program objectives, program interventions, and program activities. These are the building blocks to a strong and effective program (Box 6-2). The data from the needs assessment and the community profile are used to develop a solution for the problem. The needs analysis may have revealed multiple factors. High decay rates in a community could be influenced by a multitude of factors, including lack of fluoride in the water supply, low utilization of dental care, culturally related patterns related to snacking, and people's attitudes. Most state and some local programs set key indicators against which they measure the success of their programs. They may come from Healthy People objectives or other sources. These indicators may be helpful reference points for the development of goals and objectives.



BOX 6-2 Program Development

- The Mission Statement
- Program Goals
- Program Objectives
- Program Interventions
- Program Activities

The Mission Statement

There are many ways to write program mission statements, goals, and objectives. One method is presented here. These statements are used to focus the program, clarify expectations, provide a framework for evaluation of the program, and provide a guide for all personnel in the program.

A **mission statement** is a single statement that expresses a broad, overarching purpose for the program's existence. It serves as a broad, long-term program guide and should not include any goals, objectives, activities, or interventions. It is written as follows:

To + directional statement + quality of life or category of service area + target group

Program Goals

Program goals address identified needs and are more specific than the mission statement. Although there is only one mission statement, there can be more than one program goal supporting the mission statement. Goals are broad-based statements of desired long-term or short-term changes that, if achieved, will alleviate identified needs. They are numbered and written as follows:

To + directional statement + need area + target population

Program Objectives

Program objectives are designed to meet goals and are more specific than goals, because they guide program interventions. Objectives are designed to address needs and reasons for needs that were identified by focus groups or interviews during the needs assessment. For example, the needs assessment may have shown that Miami males develop oral cancer because they chew tobacco. Focus groups noted that professional baseball players encourage the action by chewing tobacco during major league games, that children imitate major league baseball players, and that tobacco companies target children in spit tobacco advertising. Objectives

define a desired change in the clients or the environment. Often, there are multiple objectives for each goal. Program objectives also are identified with a number to match each goal and include an extension. They are written using this formula:

To + directional statement + change in client or environment + target population

It is critical that objectives be developed with the consideration of how they will be evaluated. A common guide for writing objectives is the SMART formula. This formula has been adapted in different ways by program developers, but is extremely useful for creating objectives focused on the program goals. Objectives should be as follows:

Specific: Focus and precision are essential in setting objectives. This eliminates confusion and allows easier measurement and documentation.

Measurable: They must be easily assessed to gauge progress of the program.

Appropriate: Needs of the population group should be the central focus in the objectives of any intervention. The end result should be reasonably attainable.

Realistic/Related: Achievable, yet challenging, objectives help motivate those involved in delivering the intervention. They should also be directly related to expected outcomes.

Time Bound: It is essential that a timescale be specified to assess changes achieved. Time frames can be for intermediate or end of program outcomes.⁶

Program Interventions

Program **interventions** are task-oriented and designed to answer the explanation of the problem or identified need. They are matched to goals and identify what the program will actually provide. Needs are more effectively impacted with multiple levels and types of interventions. There are four types of program interventions:

- Educational (provision of information to target group)



BOX 6-3 Effectiveness of Oral Health Promotion Intervention

- Water fluoridation is effective at preventing dental caries. Fluoride toothpaste is another effective method of delivering fluoride.
- Improving an individual's knowledge of oral health can be achieved through oral health promotion, but the clinical, behavioral, and health significance of this is unknown.
- Information alone does not produce long-term behavior changes.
- Oral health promotion on an individual level is effective for reducing plaque levels. However, these produce only short-term changes. School-based toothbrushing campaigns aimed at improving oral hygiene are not effective.
- Few studies have assessed the effect of oral health promotion on sugar consumption. Those studies that have attempted to alter sugar consumption have used self-reported outcome measures that have limited validity.
- Health education studies, which target the entire population, may increase inequalities in oral health.
- Little evidence on cost-effectiveness has been assessed in oral health promotion. However, traditional oral health education using health professionals is relatively costly.
- Mass media campaigns are ineffective at promoting either knowledge or behavior changes, although they may increase awareness.
- Limited evidence exists on the effectiveness of screening for the early detection of oral cancer.

Reprinted with permission. Source: Watt RG, Fuller S, Harnett R, et al. Oral health promotion evaluation—Time for development. *Commun Dent Oral Epidemiol* 2001;29(3):161–166.⁶

- Direct service (provision of services)
- Organizational (changes in organizational infrastructure)
- Power (can involve litigation or law forming)

Program interventions are written as follows:

To + action term + units of service + target population

It is important to draw on the successes of others. The effectiveness of various oral health promotion interventions was evaluated and summarized by Watt et al. in 2001 (Box 6-3).⁶

Program Activities

Program **activities** are the component steps required to carry out an intervention. They are the program building blocks. For example, the activities required to administer a fluoride mouth rinse program might include sending out and then collecting permission slips,

ordering supplies, scheduling, reporting, and many other steps. Time frames are indicated for the completion of each activity. There are two types of activities, direct and indirect.

Direct activities are those steps directly involved in the delivery of the intervention. These activities involve the actual steps necessary to run an intervention. An educational session could involve such steps as reviewing materials, drafting a lesson plan, developing and printing handouts, scheduling a pilot test, running a pilot test, evaluating the lesson, revising the lesson, scheduling the lessons, and many more.

Indirect activities are the “behind-the-scenes activities” required to carry out the intervention. They are supportive in nature and not necessarily numbered. They may include record keeping, secretarial support, or equipment maintenance. A sample goals and objectives section of a hypothetical program is shown in Table 6-4.

TABLE 6-4 GOALS AND OBJECTIVES

LEVEL	FORMULA	EXAMPLES
Mission Statement	To + directional statement + quality of life or category of service area + target group	To improve the oral health of Miami, FL citizens
Goals	To + directional statement + need area + target population	1. To decrease oral cancer in males living in Miami, FL
Objectives	To + directional statement + change in client or environment + target population	1.1 To decrease the initiation of tobacco chewing among youth in Miami, FL 1.2 To decrease tobacco advertising targeted toward youth in Miami, FL 1.3 To discourage youths' imitation of major league players chewing tobacco 1.4 To increase the opportunities for tobacco cessation support in Miami, FL 1.5 To increase the early detection of precancerous oral lesions
Interventions	To + action term + units of service + target population (the types of interventions are shown in parentheses)	1.1.1 To provide 50 educational sessions for little league baseball teams (educational) 1.2.1 To sue the tobacco industry for targeting children in spit tobacco advertisements (power) 1.3.1 To provide tobacco-free professional baseball player role models. (organizational) 1.3.2 To promote tobacco-free youth baseball teams (organizational) 1.4.1 To provide a tobacco user's helpline (direct service) 1.5.1 To provide oral cancer screenings to 200 baseball players (direct service)
Direct Program Activities	Activity + date	1.1.1.1 Review educational materials used by other programs by December 1 1.1.1.2 Develop educational program by March 1 1.1.1.3 Pilot test educational program by April 1
Indirect Program Activities	Administrative Support Maintenance Risk Management	Fiscal control, record keeping, supervising Secretarial support Equipment repair and maintenance Insurance, safety procedures

THE WORK STATEMENT

The **work statement**, or action plan, explains what, where, and when the program activities are accomplished. It includes a time line for completion of each activity and a narrative

that describes the activities. It may be helpful to organize the plan in a chart similar to the one shown in Table 6-5. Another professional should be able to pick up the work statement and understand it well enough to run the program.

TABLE 6-5 ACTION PLAN

IMPLEMENTATION	INTERVENTION	MARKETING	WHERE	WHAT	WHO	WHEN	REINFORCEMENT	MONITORING
Goal One								
Objective one:								
Objective two:								
Objective three:								
Goal Two								
Objective one:								
Objective two:								
Objective three:								

Time Lines and Narrative

A **time line** is a chart that lists target dates for completion of program activities (Fig. 6-1). Various styles are effective, depending on the complexity of the program. The time line provides a sequence for staff activities and a vision of how they fit with others' concurrent activities. The intention is for timely work progression to

keep programs at or below budget. A narrative is included to describe the activity steps. For example, for Step 1 in Figure 6-1, the narrative might say: August 2010: Contact county immunization clinic, Head Start, and WIC staff to determine the most efficient way to see children. Pilot test the assessment form and complete edits of the form.

	8/10	9/10	10/10	11/10	12/10	1/11	2/11	3/11	4/11	5/11	6/11	7/11
1. Agency contacts sites/Pilot Tests												
2. Meet with focus groups												
3. Plan educational component												
4. Plan WIC/client interface												
5. Agency follow up with sites												
6. Order supplies/Orientation schedule												
7. Intervention												
8. Initial evaluation												
9. Evaluate process/compliance												
10. Make improvements												
11. Gather data												
12. Write reports												
13. Full plan implementation												

FIGURE 6-1 Community Program Time Line. A graphic time line helps visualize the flow of the program through a time period. A narrative would accompany the time line to clarify each step.

ORGANIZATION

The organization of the program plan provides details about the networking of the program and includes job descriptions, an organizational diagram, flow charts, and a program budget.

Job Descriptions

Job descriptions are written for the dual purposes to advertise for staff openings and to define and divide necessary activities in a team. They also clarify each person's role in the program. Job descriptions generally include four parts. (i) Job title, which should be simple and descriptive. (ii) Job qualifications, including a description of the minimal level of education and skills needed to perform the job. (iii) Job responsibilities, including a description of the necessary duties and activities expected. (iv) Job compensation, which is a description of the salary or wage offered, as well as direct and indirect benefits. Finally, a description of any unusual travel, any late hours, and preference for second language should be included. It may be wise to consult with agency personnel or the human resource department for help in developing the job description to ensure that legal requirements are met.

Organizational Diagram

The **organization diagram** (Fig. 6-2) details the chain of command and explains how information flows through a department, agency, or work

group. Software programs are available to help draw organizational diagrams.

Client Flow Charts

Although the organizational diagram illustrates how information flows through the system, information **flow charts** illustrate how clients or patients flow through the system. They offer checkpoints for decision making, documentation, and data collection. Geometric figures guide the reader through the chart. The planner can draw flowcharts by hand or use a computer application designed specifically for flowcharts. Figure 6-3 demonstrates a flow chart designed for an Early Childhood Caries program.

Program Budget

Inadequate funding, along with lack of resources, is one of the major reasons for program failure. Ineffective programs can result from trying to create a program with inadequate funds. Ideally, a program is planned with all the necessary funding, resources, supplies, equipment, and facilities to operate (Table 6-6). In reality, public health programs are often, by necessity, planned around predetermined, limited or mandated funds. However, creative program planners use leveraged resources by working collaboratively with other programs/players toward common goals.

There are several budget items to consider:

- **In-kind support** is provided by the agency or other entity to illustrate a match for a portion

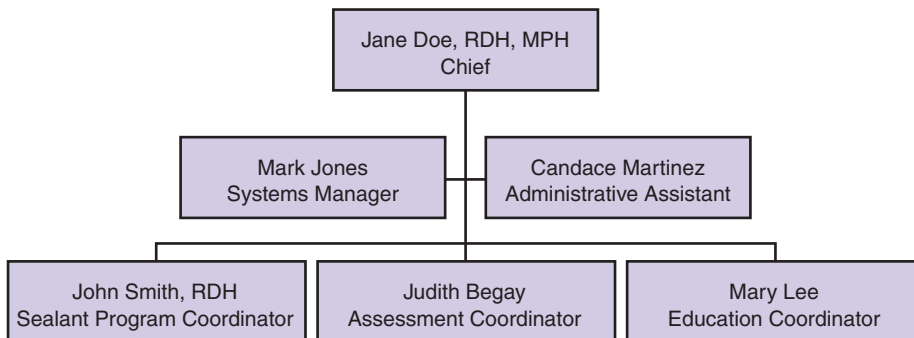


FIGURE 6-2 Organizational Diagram.

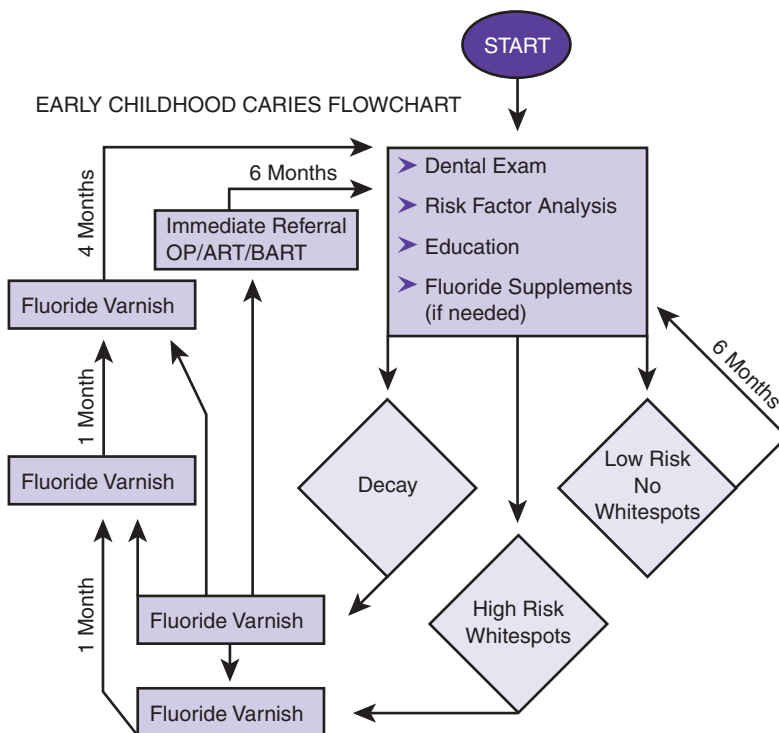


FIGURE 6-3 Early Childhood Caries Flow Chart. The OVAL denotes the start or end of the flow chart with the words Start or End inside the oval. The RECTANGLE conveys actions or steps. DIAMONDS are used for decisions or questions. CIRCLES are the “Go To” symbols, used when charts get too big for one sheet of paper or when flow charts are complicated (to avoid crossing arrow lines). BRANCHING is used for options in decision making. ARROWS connect the shapes.

of the funds. Many grant sources require an in-kind match. It is not usually required to be cash; instead it can be the estimated value of an agency’s contribution. Community-based programs can include volunteer time, travel expense, office space, and staff support in their in-kind estimate.

- Personnel expenses include salary and employee-related expenses (ERE). If employees are contracted, ERE may not be included. ERE is usually a percentage in addition to the salary. Agency personnel can estimate a percentage based on insurance costs, workmen’s compensation, social security tax, retirement contributions, and other employer expenses.

- Rent is budgeted by the cost per square foot per month times the number of months of the program or funding cycle.
- Telephone cost is budgeted by the cost per month times the number of months.
- Supplies are budgeted at full retail price, but often can be purchased at discount to allow for unforeseen price increases. It is wise to plan generously.
- Equipment may include computers, office equipment, or dental equipment. It is best to lease computers and include maintenance contracts on all purchased equipment.
- Insurance may include liability, renters, automobile, or any other necessary for the program and not included in the ERE.

TABLE 6-6 BUDGET FOR EARLY CHILDHOOD CARIES PREVENTION PROJECT

IN-KIND SUPPORT	
Office Equipment (estimate value of each)	(estimate value of each)
Phone	
Office Space/Storage	
Mirrors and Explorers	
Use of Private Vehicle	
CONTRACT PERSONNEL	
Project Director: \$30.00/hour, 4 hours/week × 36 weeks	\$4,320.00
Dentist: \$50.00/hour, 4 hours/month × 6 months	\$1200.00
Assistant: \$18.00/hour, 4 hours/month × 6 months	\$432.00
TOTAL FOR PERSONNEL	\$5,952.00
DENTAL SUPPLIES	
Toothbrushes: \$8.00/dozen × 50	\$400.00
Fluoride varnish: \$20.00/tube × 100 tubes	\$2000.00
Disposable application brushes: \$19.00/box of 144 × 100	\$190.00
Disposable dappen dishes \$35.00 per box of 1,000 × 2	\$70.00
Incentives \$1.00 × 1200	\$1200.00
TOTAL FOR DENTAL SUPPLIES	\$3860.00
PROGRAM TOTAL	\$9,812.00

- Travel may include cost per mile of a private vehicle or the daily fee plus mileage for a fleet or rented vehicle. It may also be necessary to include per diem for food and lodging when a program requires travel outside of a reasonable distance.

drive program interventions with appropriate activities to accomplish the plan. These same goals and objectives guide the evaluation of programs. Many community oral health programs begin on a small scale and later expand the program after working out any logistics during the implementation and evaluation.

EVALUATION

Program evaluation is an important component of the planning process. From the beginning of planning, it is important to consider how program goals and objectives will be evaluated. A more specific and detailed guide to program evaluation is presented in Chapter 7.

Summary

Developing a community program is a cyclical process and is designed to meet community-recognized needs. Measurable goals and objectives

Learning Activities

1. The second-year dental hygiene class at Best College has generally poor study habits. A focus group revealed that students only skim reading material, cram for tests at the last minute, and party too much. Design a small program to change this behavior.
 - a. Write a mission statement.
 - b. Write a goal for the program.
 - c. Write two or more objectives for the program.
 - d. List possible interventions that could be implemented.

2. Design a flow chart to track patients' flow through a dental clinic.
3. Design an organizational chart for a school department or place of employment.
4. Collect data about your community: environment, population, mean income, schools, major employers, influential organizations, and popular activities.
5. Using the data sources in Table 6-2 collect health information about your community and compare the information to state and national indicators.
6. Collect information about oral health resources in your community, that is, public health clinics, organizations, state practice act regulations, water fluoridation, public health programs.
7. Using the information collected in activities 5 and 6, develop a community profile, and analyze the data.
8. Identify possible interventions.

Resources

Fink A. ed. *The Survey Kit*. 2nd ed. Thousand Oaks, CA: Sage Publications, 2003.

Internet resources for program development:
Surveys:

<http://www.surveymshare.com/templates/surveyquestions.html>

<http://www.spss.com/PDFs/STIPlr.pdf>

<http://writing.colostate.edu/guides/research/survey/pop4a.cfm>

Job Descriptions:

<http://www.college.ucla.edu/personnel/jobdesc/>

<http://office.microsoft.com/>

Organizational Charts: <http://office.microsoft.com>

Sample Budgets:

<http://www.npguides.com/guide/budget.htm>

http://www.rit.edu/research/srs/proposalprep/howto_budget.html

Mission Statements:

http://www.health.state.mn.us/divs/hpcd/chp/hpkit/text/team_mission.htm

http://foundationcenter.org/getstarted/faqs/html/mission_statements.html

Flow Chart Symbols:

<http://deming.eng.clemson.edu/pub/tutorials/qctools/flowm.htm>

<http://www.mcli.dist.maricopa.edu/authoring/studio/guidebook/flow.html>

Review Questions

1. The reasons for conducting a needs assessment include all of the following EXCEPT:
 - a. gathering data to publish a paper.
 - b. identifying the extent and severity of a need.
 - c. assessing the cause of a problem.
 - d. determining the resources needed for a program.
 - e. establishing priorities.
2. Which of the following is an example of an indirect program activity?
 - a. toothbrushing education
 - b. data collection
 - c. convening a task force
 - d. repairing equipment
 - e. developing a lesson plan
3. The heart of the program plan is:
 - a. the goals and objectives.
 - b. the management information system.
 - c. the flow chart.
 - d. the needs assessment.
 - e. the organizational diagram.
4. The mission statement is a broadly based statement of desired changes that should occur to alleviate the needs that have been identified.
 - a. True
 - b. False
5. To save time and money, secondary data should be collected before any primary data are collected.
 - a. True
 - b. False
6. "To improve the oral health of Anytown citizens" is an example of a:
 - a. mission statement.
 - b. program goal.

- c. program objective.
 - d. program intervention.
7. “To decrease the consumption of high-sugar beverages at Anytown public schools” is an example of a:
- a. mission statement.
 - b. program goal.
 - c. program objective.
 - d. program intervention.
8. “To decrease dental caries of Anytown citizens” is an example of a:
- a. mission statement.
 - b. program goal.
 - c. program objective.
 - d. program intervention.
9. “To ban soft drinks at Anytown public schools” is an example of a:
- a. mission statement.
 - b. program goal.
 - c. program objective.
 - d. program intervention.

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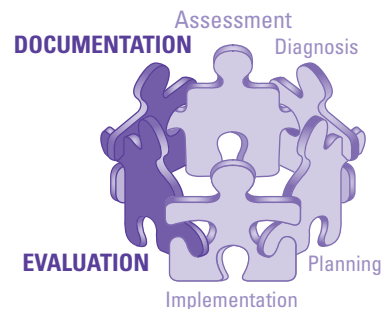
Program Evaluation

7

Objectives

After studying this chapter and completing the study questions and activities, the learner will be able to:

- Describe why program evaluation is important.
- Identify and describe the types of program evaluation.
- Define evaluation terms.
- Design a program evaluation instrument.



KEY TERMS

Attitudes
Behaviors
Efficiency
Formative evaluation
Impact
Knowledge
Management information systems

Outcome evaluation
Postprogram
Preprogram and postprogram
Preprogram and postprogram with
a comparison group
Preprogram and postprogram with
a control group

Process evaluation
Program evaluation
Qualitative
Quantitative
Reliable
Summative evaluation
Valid

See Appendix 3 for the ADEA competencies addressed in this chapter.¹

Introduction

Evaluating programs is a critical step in public health initiatives. Without evaluating both the process and the outcomes of a program, the benefits cannot be shared and the effectiveness remains unknown.

This chapter introduces the learner to program evaluation and enables participation in the process. It covers the purpose, focus, and value of program evaluation. An overview of evaluation design, data collection methods, and management information systems (MIS) is described.

PURPOSE OF PROGRAM EVALUATION

It is natural for humans to evaluate their actions. A cook tastes a dish to decide whether to add more seasonings, athletes watch videotapes to

analyze and improve their performance, and students check grade reports. In the dental hygiene process of care, dental hygienists compare reevaluation periodontal probe readings to pretreatment measurements to determine success of treatment and need for retreatment or referral. **Program evaluation** is simply an extension of this common sense practice to organized settings or programs. Public health professionals strive to improve health. They design programs and interventions, such as tobacco cessation classes, fluoride mouth rinse programs, and sealant programs. How do we know if these well-intentioned efforts are effective? Are the programs worth the effort, the time, or the money? These are questions asked by funding sources, administrators, and stakeholders; evaluation provides the answers. A combination of both qualitative and quantitative methods lends the answers to questions like how

much, why, and who cares? Finally, thorough documentation provides quality assurance to all interested parties.

The most important purpose for program evaluation is the contribution to the provision of quality services to people in need.² Evaluation is important for several additional reasons: as a means to developing good practice, to make the best use of scarce resources, to provide feedback to staff and participants, and to shape policy development.³ The results of the interventions are measured against the program objectives.⁴ The evaluation answers whether the program was successful in reducing or eliminating the identified need or problem.

Questions one might ask about programs are as follows:

- Did the program accomplish what it was designed to do?
- Did the program work better than other similar programs?
- Did the program reduce health costs?
- How could the program be improved?
- Should the program be continued?
- Does the program merit continued funding?
- Should the program be expanded?

EVALUATION TIMING

Ideally, evaluation decisions and tools are designed during the program development phase and prior to any implementation, not at the conclusion of a program. If this piece is not designed until the conclusion, the opportunity to collect pretest data is missed, and the evaluation can be biased by knowledge of program operations.

There are two types of evaluation that occur at different times. **Formative evaluation** (also referred to as **process evaluation**)⁴ occurs during the implementation process, and **summative evaluation** (also referred to as **outcome evaluation**)⁴ occurs after the intervention.

Formative evaluations help point out problems and identify opportunities to make improvements. This is similar in the dental hygiene process of care to evaluating instrumentation technique and deposit removal during the scaling appointment

during individual patient care. This type of program evaluation is tied to routine operations with practical, ongoing measurement of processes and outcomes involving program staff and stakeholders. In the implementation of a school sealant program the evaluator would want to know the answers to questions such as: How many children are served? How many permission slips were returned? Formative evaluation may answer several questions, such as: What is the nature of the people being served? Is the program operating as expected? Do the activities match the plans for the program?

In a summative evaluation, the results of the program are compared with the goals and objectives and used to determine the **impact** of the program on the community's health. This is similar to reevaluating an individual patient after treatment to determine the effectiveness of scaling on the health of the tissue. Summative evaluation answers questions such as: Has oral disease been reduced? Has tobacco use changed? How many dental sealants have been placed? What are the retention rates of sealants at various intervals? And finally, how many sealants failed? How many of those teeth decayed? How much did a sealant program cost and how does this compare to the cost of restorative treatment if the program did not exist? Summative evaluation helps all interested parties make decisions about the value and possible continuance of programs.

EVALUATION FOCUS

Evaluation methods are directly tied to the attainment of goals and objectives. It is important to judge a program by what it was designed to do. It is also important to examine why a program succeeds or fails, to consider unexpected positive or negative effects, and to examine whether the goals were appropriate for the clients served. The most appropriate focus for most evaluations is on improvement of processes, implementation, **efficiency**, or anything that makes a program more organized and cost-effective. Scheetz and Gholston⁵ use an evaluation model that asks several questions (Box 7-1).



BOX 7-1 Evaluation Questions

*How important was the problem toward which the program was directed?*² Is the ultimate goal important to responsible individuals? Answering this question involves the values of key players.

*How much of the problem was solved?*² People may have different opinions of what constitutes a successful outcome. Some may consider changes in plaque levels a successful outcome; others may consider decreased bleeding successful. Some may consider a 25% improvement a success; others may consider this a failure.

*To what extent did the activities attain the objectives?*² It may be difficult to establish a cause-effect relationship because the causes of change are sometimes difficult to establish. Certain factors not related to the program could be influencing the outcomes. A close dialogue between patients and planners may be helpful. As much as possible, it is important to determine whether the program is making a difference.

*What was the cost in resources to attain the objectives?*² The cost analysis is an important piece. It is important to measure efficiency outcomes, cost-effectiveness, and cost-benefit. This answers: What is the cost per unit of achievement? For example, what was the cost in labor and supplies per sealant? Examples of resources that affect costs include provider wages or salary, the nature of an intervention, the conditions, and the materials.

*What desirable and undesirable adverse effects occurred?*² It is important to analyze any unexpected effects because this will offer valuable information for future planning. For example, medications that solve problems usually create undesirable adverse effects. On the positive side, learning new skills can increase self-esteem.

Sources: Posavac EJ, Carey RG. Program Evaluation: Methods and Case Studies, 5th ed. Upper Saddle River, NJ: Prentice Hall, 1997.²

Scheetz, JP, Gholston LR. Applying an evaluation model to a dental public health program. J Pub Health Dent 1985;45(3):187-192.³

A combination of **quantitative** and **qualitative** methods can be used to specify and measure identifiable objectives. Together, they lend numbers and traits to tell stakeholders whether, and by how much, a program had an impact. Qualitative methods are helpful when long-term changes are expected. They are more likely to tell us why something changed, what factors are involved and, finally, they lend to program improvement more readily than quantitative methods. For example, quantitative methods may tell us that a certain proportion of people in a population received fluoride varnishes. Qualitative methods could tell us what people liked or did not like about the product or process and lend information that leads to better processes, acceptance, and outcomes.

Evaluation methods should fit the nature and timescale of the intervention.⁶ Intermediate outcomes might be a better measure for educational programs than long-term health outcomes. Educational programs could lead to health behaviors that, when sustained over a long-term, would lead to reduced risk and better health. It takes a long time to realize those health benefits. Therefore, it might make more sense to measure intermediate variables, such as changes in **knowledge**, **attitudes**, and **behaviors**, than long-term changes in disease rates or health. Intermediate outcomes could be intentions to quit smoking, improvements in plaque levels, agreement to receive sealants, or decreased sugar consumption. Unfortunately, it cannot

be assumed that the desired long-term health outcomes, such as decreases in decay or cancer rates, will occur. Although positive health changes may have occurred over a short-term, they may be superficial and dissolve over time.²

STAKEHOLDERS

The involvement of all stakeholders is essential to the evaluation process, just as it was during the program development and implementation stages. If only providers or other limited parties are involved, the scope and value of the evaluation is reduced. The participation of policy makers, funding agents, and community representatives increases the relevance and credibility of the results, as well as the likelihood of long-term participation.⁷

ASSIGNING VALUE TO PROGRAM ACTIVITIES

Programs are judged on several criteria, including their merit or quality, worth or cost-effectiveness, and significance or importance. A program can have merit but not be worth its cost. Before assigning value and making judgments regarding programs, the following questions must be answered:

- What will be evaluated?
- What aspects of the program will be considered when judging a program's performance?
- What standards must be reached for the program to be considered successful?
- What evidence will be used to indicate how the program has performed?
- What conclusions regarding program performance are justified by comparing the available evidence to the selected standards?
- How will the lessons learned be used to improve public health effectiveness?

FRAMEWORK FOR PROGRAM EVALUATION

The Centers for Disease Control and Prevention describes six steps in public health program evaluation.^{8,9} Table 7-1 summarizes those steps.

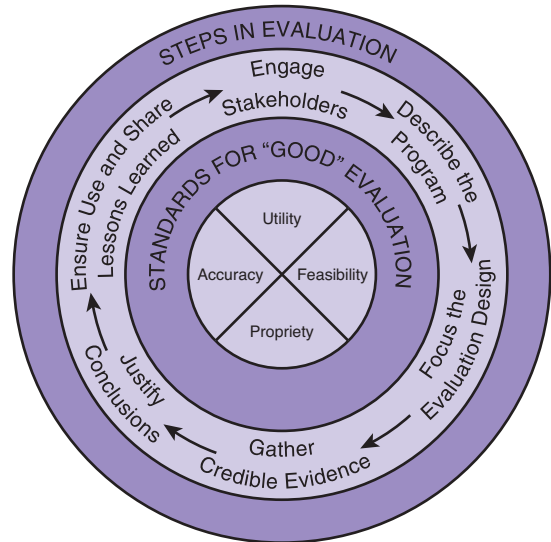


FIGURE 7-1 Steps in Evaluation (Source: Centers for Disease Control and Prevention. Practical Evaluation of Public Health Programs. PHTN Course VC-0017. Workbook.)⁹

Figure 7-1 illustrates the interrelationships of the steps.⁹

The first step in an evaluation is to involve the stakeholders.⁸ These are the individuals and agencies, previously described in Chapter 5, who are personally involved in the program, who derive income from it, whose future career might be affected by it, or who are clients or recipients of its services.²

Next, the evaluator describes the program in enough detail for others to understand such aspects as how the program works, where it is conducted and who is served, when it occurs, what is expected, what supplies and resources are used, how clients/patients interface, and the nature of clients served.

The third step is to focus the design of the evaluation on the issues most important to stakeholders. The design of the evaluation is tied to whether or not the program is resolving unmet needs; providing services; improving health; reducing risk; or changing attitudes, knowledge, or behaviors. An evaluation might be measuring whether one intervention or approach works better than another. Before an evaluation

TABLE 7-1 FRAMEWORK FOR PROGRAM EVALUATION

STEP	DESCRIPTION	DETAIL
1	Engage stakeholders	Persons or organizations having an investment in what will be learned and what will be done: • Those involved in program operations • Those served or affected by the program • Primary users of the evaluation
2	Describe the program	Convey the mission and objectives of the program being evaluated: • Statement of need • Expected effects • Activities • Resources • Stage of development • Context • Logic model
3	Focus the evaluation design	The evaluation must assess the issues of greatest concern to stakeholders while using time and resources efficiently • Purpose • Users • Questions • Methods • Agreements
4	Gather credible evidence	The information collected should convey a well-rounded picture of the program that is credible: • Indicators • Sources • Quality • Logistics
5	Justify conclusions	Conclusions are justified because they are based on evidence: • Standards • Analysis and synthesis • Judgments • Recommendations
6	Ensure use and share lessons learned	Deliberate action is taken to make sure evaluation process and findings are used and disseminated: • Design • Preparation • Feedback • Follow-up • Dissemination • Additional uses

Adapted from Morbidity and Mortality Weekly Review. Available at: <http://www.cdc.gov/mmwr/preview/mmwrhtml/rr4811a1.htm>⁸

is designed, it is important for all stakeholders to agree on what constitutes a successful outcome.

Fourth in the framework of program evaluation is the need to gather credible evidence. To be meaningful, measurement must be **reliable**, meaning that different observers look at

the same phenomenon and report similar levels. Reliability also means that a particular technique applied repeatedly yields the same result each time. An instrument that is **valid** helps measure variables objectively.¹⁰ A valid measure accurately measures a variable. An instrument can be

reliable but not valid and vice versa. A flexible tape measure that is stretched will measure the same way repeatedly and so is reliable but not valid because it is not a true measure of length.

Fifth is the justification of conclusions. It is important to base recommendations and conclusions on the weight of real evidence and to consider all the conditions and variables that might have affected change.

Finally, an evaluation is not useful to anyone unless the process and findings are documented, used and disseminated. Evaluations present valuable feedback to improve programs. Sharing the lessons learned helps others who are providing similar programs.

EVALUATION DESIGNS

Four commonly used evaluation designs are shown in Table 7-2¹¹: postprogram only, preprogram and postprogram, preprogram and postprogram with a comparison group, and preprogram and postprogram with a control group. The purpose and type of information needed determines

the selection of the design. The selection of the design also impacts the usability of the information and the ability to draw conclusions.

Postprogram Only

In **postprogram** only design, the outcomes are assessed after the program is completed. This is the least useful design because it is difficult to assess the amount of change that occurs. There is no baseline measurement taken before the program to compare with outcomes at the end of the program. This design is useful only when it is more important to ensure that participants reach a specific desired outcome than it is to know the degree of change. When this design is used, it is impossible to judge the amount of change that occurs or the influence of other factors on the change.

Preprogram and Postprogram

The **preprogram and postprogram** evaluation design enables an assessment of the amount of change. Baseline measurements taken prior to the program are compared with measurements

TABLE 7-2 EVALUATION DESIGNS

DESIGN	METHODS			
	Group Assignment	Preprogram Assessment	Program	Postprogram Assessment
Postprogram Only			Implement program with Target Group	Assess Target Group after the Program
Preprogram and Postprogram		Assess Target Group before the Program	Implement program with target group	Assess Target Group after the Program
Preprogram and Postprogram with a Comparison Group	Select Target group and similar Comparison Group	Assess Target Group before the program	Implement program only with Target Group	Assess Target Group after the Program
		Assess Comparison Group before the program		Assess Comparison Group
Preprogram and Postprogram with a Control Group	Randomly assign people from same population to Group A or Group B	Assess Program Group A	Implement Program only with Group A	Assess Program Group A
		Assess Control Group B		Assess Control Group B

Adapted from: Arizona Program Design and Evaluation Logic Model: Resource Packet. Courtesy of the Arizona Drug and Gang Prevention Resource Center.

taken at a program's conclusion. The same measurement is completed in the same way before and after a program. This type of evaluation is an improvement over the postprogram only design, but still may not offer complete confidence that the program was responsible for the outcomes because it does not account for changes in the target group that are not related to the program.

Preprogram and Postprogram With a Comparison Group

A **Preprogram and Postprogram with a Comparison Group** evaluation design includes the assessment of a group similar to the target group but who did not receive the program. Both the target and the comparison groups are assessed prior to the program, the program is delivered to the target group, and then both groups are assessed at the conclusion of the program. The comparison group must be as similar as possible to the target group demographically (e.g., gender, race/ethnicity, socioeconomic status, age, education) and in a similar situation as the target group.

The more the two groups are alike, the more confidence there is that the program was responsible for the outcomes. An example would be two same grade-level classes at the same school whose participants had plaque levels measured. Only one group receives an intervention, such as toothbrushing education. Both classes are again measured afterward and their preprogram and postprogram scores are compared.

Preprogram and Postprogram With a Control Group

The **Preprogram and Postprogram with a Control Group** evaluation design provides the greatest support for claims that the program was responsible for the outcomes. People are randomly assigned from the same overall target population to either a control or target group. In random assignment, each person has an equal chance of being selected for either group, so that the control group is as close as possible to the comparison group.

DATA COLLECTION METHODS

The information needs time, resources, skills, and available expertise to determine the selection of the type of data used to measure program outcomes. There are advantages and disadvantages to the many different ways to collect data. Table 7-3 compares data collection methods. Generally, it is best to use various techniques, as each method has its weakness. The use of several methods is complementary and, when each yields the same results, it strengthens the conclusions.¹¹

Surveys fit the needs for descriptive data and can describe, explain, or explore. For example, a survey would fit the need to know about dental practice patterns.

Experiments fit the need for testing hypotheses. For example, a dental index used in a preprogram and postprogram with a comparison group would test whether a certain product was more effective at removing plaque.

MANAGEMENT INFORMATION SYSTEMS

Management information systems help organize the data necessary to manage a program and make decisions. It may be necessary to track such information as numbers and types of services performed, sealants retained over a specified amount of time, numbers of attendees at an educational forum, or responses to evaluation forms. In private practice, dental hygienists may track production, patient recare systems, and various other data to make practice decisions as part of the dental hygiene process of care. A state sealant program may use several forms, including a medical history, permission slip, form for diagnosis of teeth to be sealed, and a record of sealants provided. Standard instruments enable a comparison within and between programs. Evaluators should develop tracking forms that are simple and user friendly. Information from forms is entered into a database to track a program's production, such as numbers per provider or children served at a school. Paper spreadsheets or computer spreadsheets are often used. Finally, information must

TABLE 7-3 DATA COLLECTION METHODS

METHODS	PROS	CONS	COSTS	TIME TO COMPLETE	RESPONSE RATE	EXPERTISE NEEDED
Self-administered Surveys (pen and pencil)	Anonymous; inexpensive; easy to analyze; standardized; easy to compare to other data	Results are easily biased; misses information; attrition is a problem for analysis	Moderate	Moderate, depending on system (mail, in-person delivery)	Moderate, depending on system (mail is lowest)	Little to gather; moderate for analysis and use
Telephone Surveys	Same as self-administered; increased ability to clarify responses	Same as self-administered; requires more staff time; misses those with no phone (low income)	More than self-administered	Moderate to high	More than self-administered	Some to gather; moderate for analysis and use
Face-to-face Surveys	Same as self-administered; ability to clarify responses	Same as self-administered; requires more staff time	Moderate to high	More than self-administered; same as phone	Moderate to high	Some to gather; moderate for analysis and use
Archival Trend Data	Fast; inexpensive; extensive data available	Comparison can be difficult; may not show changes	Inexpensive	Quick	Usually good, depending on the original collection method	None needed to gather; some needed to analyze and use
Observation (i.e., dental indexes)	Can see a program in operation	Requires training; observations can influence participants	Depends on staff time and costs	Quick; depends on the number of observations	Not an issue	Some needed to devise coding scheme and calibrate examiners
Record Review	Objective; quick; does not require program staff or participants; pre-existing data	Can be difficult to interpret; data often incomplete	Inexpensive	Can be time consuming	Not an issue	Little needed; coding scheme may need to be developed
Focus Groups	Can quickly get information about needs, community attitudes and norms; information can be used to generate survey questions	Can be difficult to analyze data; need a good facilitator	Inexpensive, depending on location; can be expensive to hire a facilitator	Groups themselves last about 1.5 hours	Good; people usually agree to participate, depending on schedule	Good interview/conversation skills; technical aspects can be easily learned

TABLE 7-3 DATA COLLECTION METHODS *(Continued)*

METHODS	PROS	CONS	COSTS	TIME TO COMPLETE	RESPONSE RATE	EXPERTISE NEEDED
Unstructured Interview/ Narratives	Gather in-depth, detailed information; information can be used to generate survey questions	Takes much time and expertise to conduct and analyze; potential interview bias possible	Inexpensive if using current staff; can be expensive to hire interviewers and/or transcribers	Varies by length of interview; analysis can be lengthy, depending on method	People usually agree to participate, depending on schedule	Good interview/conversation skills; formal analysis methods are difficult to learn
Open-ended Questions on a Written Survey	Can add more in-depth detailed information to a structured survey	People often do not answer them; may be difficult to interpret meaning of written statements	Inexpensive	Adds a few more minutes to a written survey	Moderate to low	Content analysis skills
Participant Observation	Can provide detailed information and an “insider” view	Observer bias common; can be a lengthy process	Expense based on time	Time consuming	Participants may not want to be observed	Data analysis skills
Archival Research	Can provide detailed information about a program	May be difficult to organize data	Expense based on time	Time consuming	Documents may not be able to be reviewed	Data analysis skills

Adapted from: Arizona Program Design and Evaluation Logic Model: Resource Packet. Courtesy of the Arizona Drug and Gang Prevention Resource Center.

be tabulated, summarized, and displayed graphically to make it useful and understandable.

DOCUMENTATION

Finally, no evaluation is worthwhile if the information is not reported back to the stakeholders. Just as in the dental hygiene process of care, patients must be informed of treatment outcomes. The program planner and the staff involved are accountable to program participants, decision makers, funding agencies, community leaders, and other interested parties. Responsible personnel need to generate user-friendly reports with outcomes displayed graphically, including a narrative with an appraisal of how the outcomes compared to the initial objectives, and details of what was successful in a program, what could be improved, and an accounting of the factors involved. Recommendations for the future also should be stated. Ideally, any shortcomings in the program identified during the evaluation are modified and all parties can anticipate a future with even greater outcomes. Volunteers and donors should be appropriately thanked for their contributions.

Summary

This chapter outlines the purpose, timing, focus, and value of program evaluation. Additionally, it introduces the learner to a basic framework, data collection methods, MIS, documentation and offers additional resources. Examples of evaluated information are described. The dental hygienist should be able to design a simple evaluation tool, as well as understand and contribute to the program evaluation process.

Learning Activities

1. In the learning activities in Chapter 6, the learner was asked to design a small program to improve the study habits of students at Best College.
 - a. Describe a way to evaluate whether the program made a difference.
 - b. Give examples of survey questions.
2. Write an objective to change oral cancer screening rates.
 - a. Identify an intervention to accomplish the objective.
 - b. Describe how you would evaluate the success of the intervention in accomplishing the objective.
3. Select an article about a public health intervention and
 - a. Identify the evaluation methods,
 - b. Discuss whether the methods are summative or formative,
 - c. Discuss the implications for public health practice.
4. List possible formative and summative evaluation methods for a fluoride mouth rinse program.
5. Develop evaluation methods for the interventions identified in learning activity #8 in Chapter 6.

Resources

- Internet resource for health promotion and community development: Community Toolbox Available at: <http://www.communityhealth.ku.edu/>. Accessed July 2008.
- Centers for Disease Control and Prevention. Evaluation Working Group: Resource List. Available at: <http://www.cdc.gov/eval/index.htm>. Accessed July 2008.
- Program Development and Evaluation. University of Wisconsin—Extension. Available at: <http://www.uwex.edu/ces/pdande>. Accessed July 2008.
- Centers for Disease Control and Prevention—Practical Evaluation of Public Health Programs Workbook. Course VC-0017. Workbook. Available at: <http://www.cdc.gov/eval/workbook.pdf>. Accessed July 2008.
- Handbook. (Muraskin LD. Understanding evaluation: The way to better prevention programs. U.S. Department of Education. Contract #LC89089001; Task Order #LC900940, 1993.) Available at: <http://www.ed.gov/PDFDocs/handbook.pdf> Accessed July 2008.

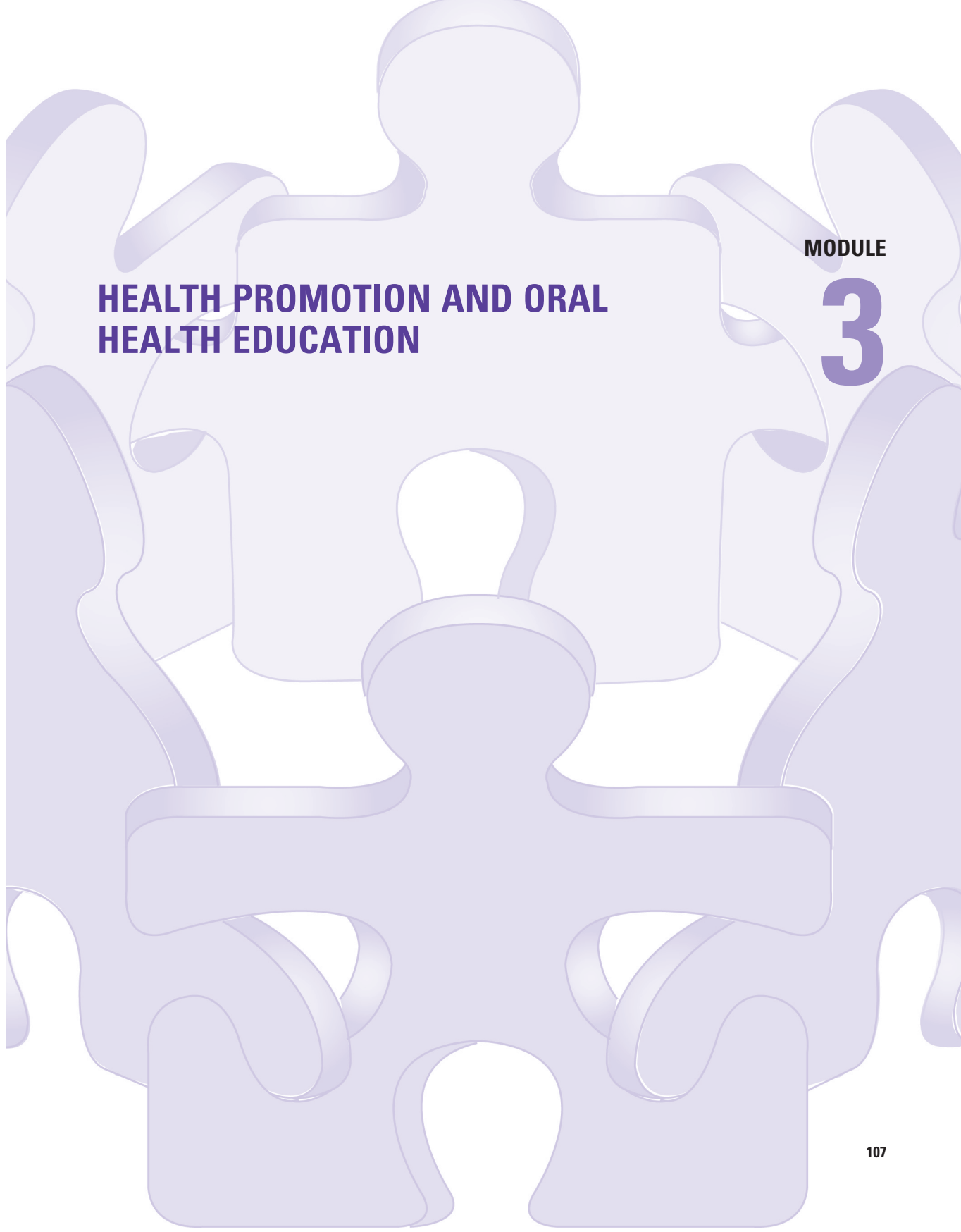
Review Questions

Anytown has 10 public elementary schools. It does not have fluoridated community water. One half of the schools are in middle- to upper-income neighborhoods and one half are in low-income neighborhoods. The children in the low-income neighborhoods represent a more diverse ethnic background than their counterparts in the higher income schools. The state health department recently completed screenings demonstrating higher dental caries rates and high rates of untreated dental caries in the lower-income schools.

1. The county hygienist has been asked to plan a program to address these unmet needs. Which of the following would be the first step in program planning?
 - a. Interview the parents
 - b. Meet with the school nurses
 - c. Form an advisory group
 - d. Rescreen the children
 - e. Recruit dentists to provide services
2. With limited funds to implement a program, which of the following is recommended?
 - a. Develop coalitions or partnerships
 - b. Write a grant
 - c. Combine resources with other health programs
 - d. Target only high-risk populations
 - e. All of the above
3. If the goal of the program is to reduce dental caries rates in the school children, which of the following would be the most effective intervention?
 - a. Toothbrushing education in the schools
 - b. Nutrition education in the schools
 - c. School-based treatment programs
 - d. Community water fluoridation
 - e. School fluoride rinse program
4. What is the most appropriate basis for evaluating an intervention that addresses these identified needs?
 - a. A survey of children's oral health knowledge
 - b. The goals and objectives of the program
 - c. A survey of local dental offices
 - d. A def's survey of the children
 - e. Program activities
5. Who should be involved in the evaluation process?
 - a. Health promotion practitioners
 - b. Policy makers
 - c. Funding agencies
 - d. Community representatives
 - e. All of the above
6. When should the evaluation methods be determined?
 - a. At the conclusion of the program
 - b. After consultation with the state health department
 - c. During the development of the program
 - d. During focus group sessions
 - e. During the summative evaluation process
7. The best example of a summative evaluation for a sealant program would be:
 - a. the number of permission slips returned by school children.
 - b. a 1-year assessment of sound surfaces compared with decayed surfaces on previously sealed teeth.
 - c. an assessment of patient flow through a sealant program.
 - d. an assessment of infection control procedures.
 - e. a staff meeting to determine if activities are being accomplished.
8. To make the best use of limited funds, how would the dental hygienist determine the criteria for sealant placement?
 - a. All children should be targeted for sealant placement.
 - b. Children with deep pits and fissures at specific grades and schools should be targeted.
 - c. Children with no access to dental care should be targeted.
 - d. Children who do not receive a fluoride mouth rinse should be targeted.
 - e. Dental sealants should not be used.

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HEALTH PROMOTION AND ORAL HEALTH EDUCATION

MODULE

3

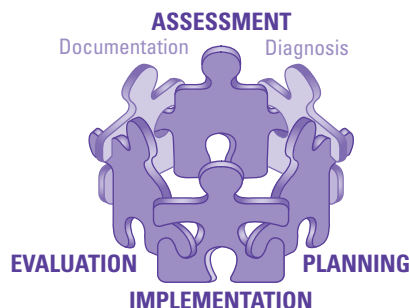
Oral Health Promotion

8

Objectives

After studying this chapter and completing the study questions and activities, the learner will be able to:

- Define oral health promotion.
- Identify the features that cause water fluoridation to be considered one of the ten top health promotion programs of the 20th century.
- Plan, implement, and evaluate an oral health program using the components of an effective oral health program and address appropriate level(s) of influence.
- Analyze how changes in society may influence the future of oral health promotion.
- Accept the role and responsibility of the oral health professional in oral health promotion.



KEY TERMS

Access to care

Barriers

Community water fluoridation

Extrinsic motivation

Fluoride tablets

Fluoride varnish

Health habits

Health information literacy

Health promotion

Initiative

Intrinsic motivation

Macro level

Meso level

Micro level

Milk fluoridation

Multifactorial

Ottawa Charter for Health

Promotion

Prevention

Primary prevention

Quality of life

Quantity of life

Referendum

Risk factors

Salt fluoridation

School-based programs

School water fluoridation

Secondary prevention

Social factors

Socially equitable

Tertiary prevention

Xylitol

See Appendix 3 for the ADEA competencies addressed in this chapter.¹

Introduction

This chapter is designed to assist the learner in understanding general health and oral health promotion and the significance on local and global health and health disparities. The chapter is divided into three separate sections: health promotion, oral health promotion, and model programs. **Health promotion**, the process of enabling people and groups of people to increase control over and to improve their health through change in policy and law, is explored. The focus of this section is on community oral health

promotion, with an introduction to individual general and oral health promotion and professional and patient self-responsibility. Individual health promotion focuses on the health of one individual at a time. Community health promotion is promoting health in society as a whole through policy change and program planning and implementation.

The reader will learn to identify appropriate audiences and approaches for oral health promotion programs by studying risk factors for oral disease, health behaviors, determinants, and disparities in oral health. Also included

are descriptions and examples of effective oral health promotion programs, including community water fluoridation and school-based pit and fissure sealant programs to assist the professional in planning, implementing, and evaluating oral health promotion activities. The learner will acquire the skills needed to participate in a fluoride intervention and to evaluate oral health promotion endeavors for populations at risk. The section concludes with recommendations for oral health programs and their promotion.

It is the desire that the learner will become passionate about oral health promotion through this unit. And this unit will inspire professionals to continually be involved in interventions and educational programs for their communities. Although community projects are arduous, they are, by far, some of the most rewarding activities in which oral health professionals can participate. There are numerous interventions, such as community water fluoridation, that impact the entire community's general and oral health.

HEALTH PROMOTION

Health promotion is the science and art of helping people and society change their lifestyles to attain optimal health. It places an emphasis on improving quantity and quality of life for all and enables people to improve their health. Health promotion includes the use of any preventive, educational, administrative policy, program, or law to achieve this outcome. Oral health promotion is aimed at four preventable oral diseases: dental caries, disease of the supporting structures, oral pharyngeal cancers, and craniofacial injuries. The poor, minorities, and the elderly share a disproportionate amount of preventable oral disease. Prevention is vital to health promotion. The goal of any oral health program should be to empower people to attain equity in health and to reduce the incidence and prevalence of oral disease through education and interventions.² Some examples of this multipronged effort in dentistry are Smiles Across America, Healthcare for the Underserved Initiative, Pipeline, and

the National Spit Tobacco Education Program (NSTEP).

GENERAL HEALTH PROMOTION

The World Health Organization (WHO) defines health promotion as “the process of enabling people to increase control over and to improve their health.”³ WHO continues to state, “Health promotion goes beyond health care. It puts health on the agenda of policy makers in all sectors and at all levels, directing them to be aware of the health consequences of their decisions and to accept their responsibilities for health. Health promotion policy combines diverse but complementary approaches including legislation, fiscal measures, taxation, and organizational change. It is a coordinated effort toward creating supportive environments and strengthening community action. Health promotion works through concrete and effective community actions in setting priorities, and making decisions. It incorporates the four pieces of the puzzle in the dental hygiene care plan: assessing, planning, implementing, and evaluating strategies to achieve better health. Community development and empowerment draws on existing human and material resources in the community to facilitate self-help, social support, participation, and ownership.”⁴ Although individual health promotion focuses on the health of one individual at a time, community health promotion has the much broader purpose of promoting health in societies as a whole.

Traditional Western medicine focuses on the treatment of disease in an attempt to improve quantity of life. **Quantity of life** refers to the number of years an individual lives. **Quality of life** is how meaningful a given life is, which is partially dependent on an individual's overall health. However, health care is evolving from disease treatment to disease prevention and, more recently, to promotion of health. Disease treatment and disease prevention are centered on quantity of life, whereas health promotion places an emphasis on improving quantity and quality of life for all.⁵



BOX 8-1 Organizations and Agencies Impacting Health Promotion

- Clubs
- Churches
- Schools
- Places of employment
- Political parties
- Community action groups
- Federal, state, and local health agencies
- Health insurance agencies

Because individual behaviors and thinking are not easily altered, health promotion must employ an interdisciplinary approach, involving clinical care, health education, research, public policy, social science, and public health, with the overarching objective to eliminate health disparities. To achieve this objective, health promotion must address factors within society, private organizations, government agencies, and policy makers to ensure access to preventive measures, appropriate health behaviors, and a healthy environment. Organizations and governmental agencies that impact health promotion are listed in Box 8-1.

Health professionals are presented with several barriers to the promotion of health. Those involved in health promotion must recognize that health and health-related issues are subject to decisions made by governmental agencies and organizations. Further, attempts at health promotion are not always successful because of the complexity of individual human motivation and other barriers, such as public policy.

The WHO has outlined strategies of health promotion in an attempt to overcome **barriers** to promoting health. WHO's five core strategies of health promotion are (i) create supportive environments, (ii) build healthy public policy, (iii) strengthen community action, (iv) develop personal skills, and (v) reorient health services.⁶ The WHO's focus is on removing barriers to health by working with people. At the **Ottawa**

Charter for Health Promotion,⁷ the WHO delineated prerequisites for health for all as follows:

1. Advocate: Health promotion aims at making conditions favorable through advocacy for health.
2. Enable: Health promotion aims at reducing differences in current health status and ensures equal opportunities and resources for all to achieve health.
3. Mediate: Health promotion aims at involving people in all walks of life as individuals, families, and communities. Strategies should be adapted to the local needs of countries and regions to consider differing social, cultural, and economic systems.
4. Build healthy public policy: Public policy and policy makers at all levels should consider the health consequences of their decisions and accept responsibility for the same.
5. Create supportive environments: Make global decisions that are conducive, not detrimental, to health.
6. Strengthen community action: Set priorities, make decisions, and plan and implement strategies to achieve health through community action.
7. Develop personal skills: Provide information through education to individuals that enhances life skills that ultimately increase health options.
8. Reorient health services: Health professionals and organizations must move in the direction of health promotion.

These principles address the role of government in public health outlined in Box 1-1 and the essential public health services in Box 1-2 in Chapter 1.

Health is of primary concern to many because of its effect on quality of life. The United States has begun to address this concern through Healthy People, which outlines specific goals, objectives, and outcomes that target health disparities. "Healthy People has set and monitored national health objectives to meet a broad range of health needs, encourage collaborations across sectors, guide individuals toward making informed

health decisions, and measure the impact of our prevention activity.”⁸ The Healthy People Toolkit, a companion document described in Chapter 5, provides communities with tools for planning interventions.⁹ A Canadian document, *New Perspective on the Health of Canadians*, has challenged traditional views about health. Four main elements—human biology, environment, lifestyle, and health care organization—have contributed to the knowledge and development of health promotion, health protection, and health care.^{10,11}

ORAL HEALTH PROMOTION

There is no single indicator of oral health. However, there are health determinants and **risk factors** that impact health, such as genetic constitution, individual and group behavior, social and physical environment, and policy and interventions.⁸ Health depends on a complex interaction between determinants of health. Thus, health outcomes are dependent on health habits, environment, and host susceptibility. The four common, preventable oral diseases have modifiable risk factors that health professionals can target when developing an oral health promotion program.

Recent studies have elucidated links between general health and oral health, making the importance of oral health more significant than previously thought. For many years, oral health professionals, especially dental hygienists, have focused their care and philosophy of care on prevention. These current findings make that philosophy even more relevant. Numerous diseases or disease processes are related to oral health and many systemic diseases have oral manifestations that may be the initial signs of the disease. The oral cavity is the portal of entry and site of disease for bacterial infections that affect general health. The function of the oral cavity can be adversely affected by medications and treatments, which may have a negative effect on the patient’s treatment. Oral infections increase the morbidity rate for immunocompromised and hospitalized individuals. For example, individuals with diabetes are at greater risk for periodontal disease. Further, association between cardiovascular disease, stroke, and adverse preg-

nancy outcome has been found in animal studies and some human studies.^{12–14}

The biological and social relationships between general and oral health challenge oral health professionals to focus their efforts on oral health promotion in order to have a positive influence on general health. However, community health professionals have discovered that education alone will not prevent disease; a more global approach is needed.

Oral health promotion includes educational programs, such as tobacco prevention and cessation programs, and public school oral hygiene instruction. Social programs include water fluoridation and school sealant programs. Legislative activities include creating laws and funding for programs that promote oral health and create increased access to care.

Oral disease is a biological, psychological, and social phenomenon. Inasmuch as traditional Western medicine has attempted to make disease a biological problem, it is necessary to reframe health and disease as **multifactorial**. Effective oral health promotion strategies should focus on the structure of assuring the availability of and access to appropriate oral health services, particularly preventive technology. The oral health professional has a responsibility to promote health and to encourage individuals and society to take responsibility for their oral health. Oral health professionals must take an active role in changing the perceptions related to oral health by being involved in local and state initiatives that promote health so that oral health becomes an integrated part of general health. The perception of the public, policy makers, and other health care providers must be influenced so that public policy can support overall health.^{14,15} Health care providers have a social obligation to promote the health of the community through community action, community service, or political action.

PREVENTION AND ORAL HEALTH PROMOTION

Prevention is an essential aspect of oral health promotion because most oral diseases are preventable. Although prevention is a critical part

of health promotion, it is not by itself sufficient to improve the quality of life. The purpose of prevention should be to ensure that a disease process never starts or is curtailed at an early stage. Early interventions are central to preventing many oral diseases.¹⁶ Former United States Surgeon General, Dr. David Satcher, reports, “safe, effective disease prevention measures exist that everyone can adopt to improve oral health and prevent disease.”¹⁴ Dental caries; diseases of the supporting structures, including gingivitis and periodontitis; many oral pharyngeal cancers; and sports-related craniofacial injuries can be prevented.

Three levels of disease prevention—primary, secondary, and tertiary—have been identified. **Primary prevention** is the intervention in disease before it occurs. Primary preventive interventions include community water fluoridation, fluoride varnish, pit and fissure sealants, and preventive education. **Secondary prevention** is the treatment or control of disease early in the process. Examples of secondary preventive measures are conservative amalgam restoration, remineralization of early caries, and conservative periodontal therapy. **Tertiary prevention** is limiting the disability from a disease, or rehabilitation of an individual. Examples of tertiary prevention are dentures or other prosthetic dental devices and periodontal surgery.

In the past, preventable diseases have been treated after they occur; in contrast, health promotion is intended to reduce the incidence of these diseases. One way that health promoters reduce disease incidence is through influencing social factors.

Social Factors in Oral Health Promotion

Social factors, including customs, values, social networks, and ethnicity, are associated with oral disease. Social factors that impact general health include exposure to conditions that contribute to illness, susceptibility of disease, habits and values, and general social changes that alter resources.

Sociologists and anthropologists have found that oral health has extensive social implications. Well-being and quality of life are related

to oral health. Untreated oral disease diminishes the quality of life through lack of sleep, limited eating, and depression. Oral disease has further negative impact, affecting the ability to chew and swallow foods and, therefore, limiting the quality and selection of foods. Individuals with craniofacial dysfunction report that oral conditions limit communication, social interaction, and intimacy as a result of loss of self-image, limited self-esteem, and increased anxiety and depression. Conversely, oral disease and pain place a burden on society through loss of work and school days.¹³

Social factors may affect the health of an individual on the **micro level**, influencing the individual; the **meso level**, involving institutions, organizations, and social networks; or the **macro level**, impacting social, cultural, and political agencies.

MICRO LEVEL: INDIVIDUAL

Characteristics, such as age, gender, socioeconomic position, ethnicity, and race may dictate one's place in a culture, community, society, or family group. Age is correlated with the occurrence of oral disease and conditions, as well as the use of dental services. The young and the elderly often have limited access to care as a result of transportation needs or other obstacles. Yet, there is little evidence that aging itself causes changes in host resistance to oral diseases or disorders. Rather, accumulated exposures to systemic disease, trauma, and adverse environmental and social conditions result in a cumulative impact.¹⁷ An example of the micro level of influence can be seen in family income levels. Family income has a direct impact on health and oral health. A disproportionate number of minorities are at lower socioeconomic positions and have poorer oral health.

Socioeconomic position has an influence on oral health; the lower socioeconomic groups have lower access to health knowledge and care. The cost of health care, whether real or perceived, is a barrier for those of lower socioeconomic position.

MESO LEVEL: INSTITUTIONAL

Institutions, organizations, and social networks influence and sustain individual behavioral norms and health practices. Social networks extend from the family as the primary unit, to small groups and larger organizations, from which health habits arise from the family. The family is the most powerful social determinant in oral health; values, beliefs, and knowledge stem from the home and may be based in cultural traditions. Moreover, the family acts as a social network, influencing norms throughout life. A mother who was taught by her mother to dip her baby's pacifier in honey to appease her fussing infant is an illustration of the role that family and culture play in the oral disease process. In that culture, it is believed that a child should be happy and the mother has an obligation to assure the child's satisfaction. Mothers from this culture learn very early how to calm a crying child. This mother is convinced that she is being a good parent and may not realize the damage she is causing her child. Health professionals may recognize that the child will likely develop Early Childhood Caries, but the mother may not. Even if the mother realizes the ill effects of the honey, she may find it more important, based on cultural values, to appease the child. The cultural habit of the sugary food on the pacifier contributes to the disease process, whereas the baby may not develop carious lesions without the honey.

Groups and organizations, such as athletic associations, parent-teacher associations, and professional organizations, reflect social norms that influence oral health. For example, professional athletes are powerful role models for youth. Young athletes imitate professional athletes. When professional athletes use tobacco, young people aspiring to be like them are more likely to use tobacco. These organizations can also act as a source of health information, as in some of the tobacco education programs that will be discussed later.

MACRO LEVEL: AGENCIES

Culture and society have control over oral health at the macro level. Evolving values and beliefs in large institutions and government influence their

policies. These policies reflect society's beliefs, which define the missions and purposes of institutions.¹⁸ One example of the impact that values have on health is Medicaid dental coverage for adults. Until recently, oral health was not viewed as important and, therefore, individuals and, more specifically, politicians did not value oral health. Individuals who did not understand the importance of dental services formed Medicaid policy and, therefore, many states do not offer dental coverage for adults. This can also be seen in the number of total Medicaid dollars allocated for all dental care. One study, conducted by Milbank Memorial Fund, reports Medicaid underfunds dental care for children. Dental care is 25% to 27% of total health care spending for children, but only 2.3% of Medicaid spending for children.¹⁹ In addition, states experiencing budgetary shortfalls often elect to eliminate all state-funded dental care for adults while maintaining other health care, demonstrating the value that policy makers ascribe to oral health.

Psychological Factors in Oral Health

If positive health behaviors lead to staying healthy and negative health behaviors lead to disease, why is it that those involved in health promotion do not simply tell their patients to brush and floss daily, not use tobacco, stay out of the sun, wear a seat belt in a car, and wear a helmet when they ride their bike? Adopting these positive health behaviors would result in a dramatic reduction of oral disease prevalence.

Changing a behavior is difficult even if the change is important in maintaining health. Behaviors depend on the individual's knowledge, beliefs, and values and require compliance.²⁰ Although oral health professionals can educate, they cannot change an individual's behavior. The patient must value and have access to preventive measures to adopt positive health behaviors. It is not enough for individuals to value prevention if they do not have access to preventive agents. Conversely, it is not enough for individuals to have access to preventive agents. An illustration of this: if a patient has dental floss, but they do not understand or believe that they are susceptible to

disease or value oral health, they are not likely to use the floss on a regular basis. Likewise, if the individual understands and values oral health yet cannot afford dental floss, they are still unlikely to change the behavior.

Social, cognitive, and emotional factors such as stress, values, attitudes, self-esteem, helplessness, vulnerability, isolation, emotional poverty, family modeling and beliefs, and the influence of the media play a role in health behaviors.²¹ Positive health behaviors that promote general health also contribute to oral health. One of these behaviors—eating a diet high in fiber and low in fat to promote cardiovascular health and reduce certain types of cancers—has also been found to reduce the incidence of oral cancer. Eating a diet low in simple carbohydrates helps reduce the incidence of obesity and helps control dental caries. Health behaviors that improve oral health include regular toothbrushing and use of interdental cleaning devices, regular self-oral exams, and the use of oral protective mouth guards and protective gear during sports activities. The lines between the social and psychological factors become fuzzy and overlap in the discussion of health habits. Psychological habits can be influenced by an individual's environment. For example, if a person is attempting to stop smoking when their partner continues to use tobacco, the environment is such that it is much more difficult for the person to quit.

HEALTH HABITS

Health habits can influence health either positively or negatively. Regular exercise, adequate rest, and proper nutrition have a positive effect on health and wellness. In contrast, negative health habits, such as poor diet, excessive stress, and alcohol abuse, contribute to disease. Negative oral health habits, such as tobacco use (pipes, cigarettes, smokeless chew, and snuff), anorexia, bulimia, and drug abuse, have a deleterious effect on oral health. On the other hand, positive habits of regular flossing and brushing and self-oral cancer screening promote oral health.

Health habits are developed in early childhood because of social and cultural norms. Although habits are formed at a young age, they can be changed with new information and individual motivation. The goal of patient motivation is to assist the person to move from a state of unawareness to a positive oral health habit.

HUMAN MOTIVATION

Motivation is complex, yet it is necessary to bring about behavioral changes that promote health. There is a saying, “Getting between the teeth is easy. It is getting between the ears that is difficult.” Individual performances are based on the degree to which they are motivated. Individual expectations, ideas, feelings, desires, hopes, attitudes, and values shape motivation. Motivation is either **intrinsic** (from within oneself) or **extrinsic** (from an outside source). A man who sees the dental hygienist because his wife told him that his breath smells bad is motivated extrinsically. He is motivated by the hope that his breath will no longer offend his wife. Intrinsic motivation comes from within one self. A woman who stops smoking because she believes it is bad for her health is an example of intrinsic motivation. This woman may have gained new knowledge or had a change in values that resulted in a behavior change. Intuitively, it makes sense that intrinsic motivation is more powerful. The will to change because of belief in something is much stronger than the influence of another person.

Reinforcement and punishment support behavior change. Effective motivators recognize their patient's values, expectations, feelings, and ideas, and direct the patient to reinforce positive behavior. Models and theories of behavioral change and motivation will be discussed in greater detail in Chapter 9.

BEHAVIORAL CHANGE: A PSYCHOSOCIAL VIEW

Volumes have been written on the nature of behavioral change. Psychologists have been studying behavior and how to bring about changes in behavior for years.

Behavioral change is complex, and humans must be viewed in their social context. Viewing people in their social context means seeing how they live, what their daily life is about, and understanding what dynamics might support or interfere with positive health behaviors. The following example illustrates the difficulty of trying to motivate a young mother to change her behavior. Maria, an 18-year-old single parent, works at night at the local minimarket to support herself and her 1-year-old daughter. The absent father does not provide emotional or financial support. Maria's family disowned her when they found out she was pregnant. When she was kicked out of her parents' house, she rented a small, one-bedroom, downtown apartment. Because she is determined to provide a good life for her daughter, Maria is attending the local community college during the day and working 12-hour shifts at night. Maria is struggling to keep up with her studies while working long hours and caring for her daughter. When she gets home from work, the baby is awake, and Maria is exhausted. She rocks the baby for a few minutes and puts her to bed with a bottle of milk so she will quickly fall asleep. Maria was told that giving a baby a bottle with milk at bedtime can cause cavities, but she is just too tired to listen to her baby cry.

Recognizing how complicated life is at times and trying to understand how life's complexity can interfere with doing what someone knows is best, is important in any health promotion program. The professional must consider the life and lifestyle of individuals in the target population to develop an effective oral health promotion program.

Psychological factors work in harmony with social factors to promote health. Health promotion activities that utilize both social and psychological motivators are often successful. Weight watchers works with individuals who have expressed a psychological motivation to maintain a healthy weight throughout life. They utilize social motivation by having clients weight in as a group. The peer pressure is intended to further motivate individuals as they lose weight.

ACCESS TO CARE AND UTILIZATION OF SERVICES

Access to care and utilization of services are important factors in determining the oral health of certain groups of individuals.¹⁵ Access to dental care varies with gender, race/ethnicity, income, and education levels. More than 108 million children and adults living in the United States do not have dental insurance, 2.5 times the number without medical insurance.¹⁴ Only 42% of individuals ages 25 years and older with less than a high school education visited the dentist one or more times in the previous year compared with 74% of those with at least some college education.¹⁴ Only 69% of the U.S. population reported visiting a dentist or dental clinic within the past year.²² The Surgeon General's Report on Oral Health states that women use dental services at a higher rate than men; Hispanic individuals had the lowest use; and Whites had the highest use. Nearly twice as many individuals living above the poverty level visit their oral health care provider as individuals below the poverty level.¹⁴ Further, many families with income levels above the poverty level cannot afford dental services.

COMPONENTS OF EFFECTIVE ORAL HEALTH PROMOTION PROGRAMS

The complexity of human nature, our society, and oral diseases demands that effective oral health promotion programs have specific components. An effective program is well planned, outlining the target population, in its objectives and goals. Aspects of effective health promotion programs are listed in Box 8-2.

Interventions

An intervention is defined as any health action—any promotive, preventive, curative or rehabilitative activity—in which the primary intent is to improve health.⁴ All planned activities that occur between baseline assessment and final evaluation are termed interventions. Interventions that have multiple activities are more likely to succeed than those that employ only a single



BOX 8-2 Aspects of Effective Health Promotion Programs

- Not dependent on compliance
- Cost-effective, cost-benefit analysis
- Assurance of correct use
- Adequate funding
- Available to those in need
- Effective in reducing disease incidence
- Feasible
- Safe
- Evaluated frequently
- Based on partnership
- Centered on pluralist methodologies

Adapted from Gift HC. Prevention of oral diseases and oral health promotion. *Curr Opin Dent* 1991; 1:337–347.¹⁶



BOX 8-3 Aspects to Consider When Selecting Appropriate Interventions

- Fit between the goals, objectives, and activity
- Fit between target population and activity
- Level of influence desired
- Activities based on theory
- Adequate resources to support the activity
- Proven effective program
- Single or multiple activities.

Adapted from McKenzie JF, Smeltzer JL. Planning, implementing, and evaluating health promotions programs: A primer. 3rd ed. Needham Heights, MA: Ally and Bacon, 2001.²³

activity. Interventions should be effective and efficient and based on sound rationale. Activities such as communication, education, community advocacy, health status evaluation, incentive and disincentive, and behavior modification may be used as part of an intervention.

Cultural competence, the process of effectively working within a cultural context of an individual or community from a diverse background, is an integral part of intervention and education. See Box 8-3 for considerations in selecting an appropriate intervention.²³

Education

Education alone is not effective in preventing diseases.²⁴ Personal values must be changed and interventions must be accessible. Education is another health promotion activity that has been determined effective if used with other techniques. Health promoters have defined education as any combination of learning experiences or educational interventions designed to help

individuals or groups learn new health information and develop new health behaviors.

Education should be specific to the target audience. For example, a tobacco education program that targets sixth grade children should include age-appropriate information, activities, and reading materials that are entertaining and easy to understand. The health promoter should capitalize on what many sixth grade teachers recognize; for example, school children are captivated by interactive computer programs. Fun, interactive computer activities for classrooms or adjunct education that centers on oral health promotion should be developed. Specific information on health education principles is addressed in Chapter 9.

MODEL PROGRAMS

The Task Force on Community Preventive Services,²⁵ an independent, nonfederal group, was formed to evaluate oral health interventions. The Task Force made recommendations to those

starting, planning, and implementing programs as follows:

1. Assess goals in light of the national goals and objective.
2. Assess the current burden of oral health conditions in their populations.
3. Review the current status and history of intervention activities.
4. Identify opportunities for improving intervention effectiveness and oral health status.

United States

The Task Force conducted a systematic review of interventions to promote and improve oral health. The interventions were aimed at preventing dental caries, oral pharyngeal cancers, and sports-related craniofacial injuries.^{25–28} Educational programs, such as statewide tobacco education projects, were not evaluated.

The Task Force strongly recommended community water fluoridation and school-based sealant programs among the interventions aimed at preventing or controlling dental caries, stating that these programs proved to be effective oral health promotion programs.^{25–28} Further, the Centers for Disease Control and Prevention (CDC) strongly recommends the same two community-based interventions, community water fluoridation, and school dental sealant programs.²⁹ These interventions were evaluated on the following:

- Effectiveness: Did the intervention reduce dental caries prevalence?
- Applicability: For what population is the intervention useful?
- Positive or negative effects: Were there any added benefits or ill effects caused by the intervention?
- Economics: Was the intervention cost-effective to deliver?
- Barriers: What might interfere or prohibit the delivery of the intervention?²⁶

SCHOOL-BASED PIT AND FISSURE SEALANT PROGRAMS

School-based programs deliver pit and fissure sealants at schools or in private practices to

children unlikely to receive dental care. These programs may partner with the local schools, the CDC, the National Institute of Dental and Craniofacial Research, Health Resources and Services Administration, and the Indian Health Service to target children at risk for dental caries. The CDC reports that school-based pit and fissure sealant programs reduce dental caries as much as 60%. One exemplary school-based pit and fissure sealant program is Healthy Smiles for Wisconsin. This coalition of 25 agencies was organized to place sealants in 3,000 school-age children during the 2000 to 2001 academic year.³⁰

PARTNERSHIPS

Effective oral health education and interventions rely on partnerships. School-based sealant programs are one example of partnering to create effective interventions. Many philanthropic organizations are joining with universities, community health agencies, and the federal government to make the objectives of Healthy People a reality. The Robert Wood Johnson Foundation is providing support to various oral health initiatives, including Pipeline and Profession and Practice: Community-Based Dental Education. Pipeline has three areas of concentration: (i) recruitment and retention of low-income and minority dental students, (ii) establishment of community-based practices for senior dental students in areas of high need, and (iii) development of dental curricula that support service delivery.³¹ The Alaska Native Tribal Health Consortium's Dental Health Aide Therapist Workforce Model is an oral health program serving isolated Alaska Native communities. The goal of the program, funded by Kellogg Foundation, is to improve the quality of services to vulnerable children and families who have some of the highest levels of measured oral disease in the country. Based on a model in New Zealand, the program trains community members to provide preventive services, perform fillings, extractions, and other limited dental services for children.³²

NSTEP partners with baseball star Joe Garagiola, the Major League Baseball Players

Association, the Professional Baseball Athletic Trainers Society, the American Coaches Association, and Little League Baseball Incorporated. NSTEP provides educational resources to schools, community members, and health professionals through a Robert Wood Johnson Foundation grant. This program excels at recruiting professional baseball players as role models to educate young athletes about the harms of spit tobacco.³³

Other partnerships that are forming are between State Departments of Health such as Minnesota, California, New Mexico, and Arizona are working with dental hygienists who have an expanded scope of practice to increase access to oral health services. Minnesota was the first state to adopt the Oral Health Practitioner (OHP). Through collaboration with a Minnesota licensed dentist, the OHP will provide oral health services in underserved areas. The OHP will have primary diagnostic, educational, palliative, therapeutic, restorative, simple extractions and prescriptive authority.

COMMUNITY WATER FLUORIDATION

This section is designed to provide an overview of **community water fluoridation** as it relates to oral health promotion. For a more comprehensive discussion on community water fluoridation refer to one of the many preventive dentistry textbooks. The CDC stated that community water fluoridation was one of the ten most significant public health measures of the 20th century.³⁴ Community water fluoridation is the upward adjustment of natural fluoride levels in a community's water supply to prevent caries. Communities have been optimizing the level of fluoride in water systems for more than 60 years. More than six decades of research has proven the safety of water fluoridation.³⁵ The benefits of fluoride in strengthening tooth enamel, reducing sensitivity of exposed roots, and remineralizing teeth has been so thoroughly documented that it is generally accepted as a fact within the dental community.^{36,37} The CDC recommends an optimal concentration of 0.7 to 1.2 ppm, depending on the average maximum daily air temperature

of the area.³⁸ The American Dietetic Association strongly reaffirms its endorsement of the use of systemic and topical fluorides, including water fluoridation as an important health promotion measure.³⁹ The 2000 Dietary Reference Intakes also established recommendations for fluoride intake.⁴⁰

Why Is Community Water Fluoridation Successful? Water fluoridation is a model oral health promotion intervention. It is **socially equitable**; community members who have access to public water receive the benefits of fluoridated water regardless of age or socioeconomic position. The fluoride levels are adjusted at the water treatment plant, based on the naturally occurring concentration. Those in need receive the benefits of the fluoride without concern for using it correctly or the costly service of a health professional. Water fluoridation strengthens the host, the tooth enamel, without requiring individual behavior changes; no active participation is required. Water fluoridation as a model intervention has been diminished by the increase in consumption of bottled water. However, it remains one of the more effective interventions, and some bottled water providers are beginning to add fluoride.

Water fluoridation is cost-effective and much less expensive than restoring a single tooth. It is estimated that the range of cost to optimize the fluoride levels in community water supplies is \$0.40 to \$2.70/person/year.²⁶ This can be compared with the dietary fluoride supplement; estimated cost of \$37/person/year. A cost-benefit analysis revealed that for every dollar spent on fluoridation, \$80 are saved in treatment costs.³⁸ Local, state, and federal agencies partner to support the optimization of fluoride in community water supplies. It is easily funded through local, state, and federal budgets. The CDC recently supported communities with the initial installation of the fluoridators and monitoring devices. Community water fluoridation is not difficult to implement and monitor through standard community water systems.

Community water fluoridation decreases tooth decay in adults by nearly 35%.^{41,42} Children who lived in fluoridated communities had 50%

to 60% fewer decayed, missing, and filled permanent tooth surfaces in comparison with those children living in nonfluoridated communities.⁴³ The impact that fluoridation has on caries can frequently be evaluated by oral health surveys. One of the most significant benefits of water fluoridation is the multiple mechanism of action; it acts as a topical and a systemic agent, as well as demonstrating antimicrobial activity to reduce dental caries. The primary mode of action is topical, in that it promotes remineralization and inhibits demineralization by continually bathing the teeth in saliva with low concentrations of fluoride.

In spite of the benefits of water fluoridation, only 66% of the U.S. population received fluoridated water through public water supply systems in 2000.³⁸ Only California, Connecticut, Delaware, Georgia, Illinois, Minnesota, Nebraska, Nevada, Ohio, South Dakota, District of Columbia, and the Commonwealth of Puerto Rico legislate mandatory statewide fluoridation.

Water Fluoridation—Public Policy Change. Water fluoridation is the only community health issue that is voted on by the public. The community does not vote on immunization, water purification, or air contaminate levels. Although it may be evident to health professionals that water fluoridation improves health for all, for voters, it is a social, economic, and psychological issue. Voters have heard propaganda from those opposed to fluoridation about the ill effects of water fluoridation, such as the unfounded claims that it lowers the IQ or causes cancer.

Oral health professionals have an obligation to promote water fluoridation. For example, dental hygienists adhere to the American Dental Hygienists' Association ethics code that describes beneficence, "We have a primary role in promoting the well-being of individuals and the public by engaging in health promotion/disease prevention activities."⁴⁴ Water fluoridation is clearly an effective health promotion intervention, establishing an ethical obligation to be involved.

Fluoride Campaigns. Although fluoridation can be legislated at the local or state levels, local enactment is most common. Local health officials in many communities have the authority to

implement water fluoridation but rarely execute this authority. Instead, water fluoridation is more commonly implemented through a public initiative or referendum. Voter **initiative** is the process whereby an action is placed on the ballot by request of a citizen group. Voter **referendum** is the process whereby an action by public officials is placed on the ballot for voter support. For example, in 2001, the Flagstaff, Arizona, city council voted to optimize the fluoride levels in community water. Because a group opposed to community water fluoridation wanted "pure water," they gathered enough signatures for a referendum vote to overrule the city council's authority. The issue was placed on the ballot and, unfortunately, the public voted not to implement water fluoridation. Requests could have been made to place the water fluoridation on the ballot without a city council decision, which would have been an initiative.

A target goal for Healthy People 2010 is for fluoridation of 75% of U.S. community water supplies.⁴⁵ To achieve this goal and to avoid devastating defeats, community readiness must be assessed. Recall the components of a needs assessment from Chapter 6, including taking a proactive approach, obtaining community buy-in, creating targeted interventions, designing cost-effective interventions, identifying sufficient resources, and assessing community-recognized need.

Taking a proactive approach to initiating community water fluoridation requires assessing the readiness of the community by determining public opinion, political climate, media influence, community apathy, demographics, external forces, public awareness and perception of fluoride, and health professional politics.

Considerable preparation is necessary prior to a water fluoridation campaign. Those involved must be committed to an endeavor that may take years to come to fruition. One of the first steps in a community water fluoridation campaign is to identify available resources. Educating the public, engaging an experienced campaign manager, and forming a political action committee (PAC) are expensive and should be considered prior to beginning a campaign. Frequently, organizations such as the CDC, American Dental Association,

or the American Dental Hygienists' Association set aside funds to support public health initiatives such as water fluoridation. Creativity is needed to find funds—it will not be easy or inexpensive.

Community education should start before announcing an official campaign and should continue until well after water fluoridation is implemented. The education should focus on the positive scientific data, speaking to the safety, cost-benefit, and efficacy of fluoride. The multilevel approach should be used in education, including in-office education; walking initiatives; get-out-and-vote drives; and TV, radio and newspaper ads. Activities should concentrate on safety, cost-benefit, and efficacy and should avoid negative campaigns. Negative campaigns do not work. Instead, they raise voter doubt. Education projects should present the facts, not argue

or debate with so-called experts opposed to fluoride. Enlist trusted community leaders to get involved in education. Community leaders have built trust with citizens and are not perceived by individuals as “the authority,” telling them what is best for their health.

Background knowledge and preparation are essential prior to initiating a campaign. See Box 8-4 for information on preparing for a campaign.

It is critical to know the position of the local media prior to initiating a campaign. The local media have a powerful influence in politics and can be a best friend or a worst enemy. Using the media can backfire on a campaign if they are not in support of community water fluoridation. It is also important to know what type of media the voters use as their source for information. Older,



BOX 8-4 Preparing a Water Fluoridation Campaign

- Know the history of previous local water fluoridation attempts.
- Determine the sentiments of city council members.
- Get to know your city council members.
- Consider the political climate.
- Understand the process, timing, paperwork, water policy, and local budgets.
- Follow local politics.
- Know your area's natural fluoride levels.
- Do not expect to be the absolute authority on fluoride.
- **DO NOT PARTICIPATE IN A DEBATE.**
- Be prepared.
- Have a plan.
- Develop a strategy and tactics.
- Recruit outside experts.
- Include local or national celebrities.
- Have a wide base of support.
- Form a citizen's PAC when appropriate (donations to a PAC are tax deductible).
- Research, READ, READ, and READ, both the supporting and the opposing information.
- Form a speaker's bureau of trained speakers. Toastmasters is a good place to get experience speaking. The ADA may also conduct training.
- If asked to speak at a public forum, assign individuals to address specific topics. For example, assign one speaker to address safety. This speaker should read and know both the supporting and opposing safety information.

educated people are more likely to read the newspaper. Local newspapers are more likely to investigate and report the issue more completely than other forms of media. Younger, busy individuals use television as a source of information. Television reports are typically short, brief bits of information. A rapidly growing source of information is talk radio. Nine of ten talk radio listeners are registered voters, compared to six of ten in the general population.⁴⁶ Talk radio is an outlet for many who otherwise do not have a platform; antifluoridationists frequently use this form of media to send their message. The Internet is also a rapidly growing source of information, although some sites are accurate and scientific and others are not, and the public may not necessarily know how to evaluate them.

Knowing who votes and when is beneficial in planning a fluoride campaign. It is also important to know if your community demonstrates voter apathy, as low voter turnout is not positive for water fluoridation. Low voter turnout generally has a negative impact because of a contingent that always votes and always “no” regardless of the issue exists in most communities. With low turnout, this group can sway the outcome of the election. Voter turnout is higher during mayoral elections. The typical voter, according to the U.S. Census Bureau, is well-educated, middle class, urban, White, female, and a homeowner. To ascertain local voter information, it may be beneficial to conduct a public opinion poll, determining how many people will vote and how they will vote on the fluoride issue.²⁴

Ethics of Community Water Fluoridation.

Research has proved that fluoridation is safe and effective, yet opposition argues the ethics of adding an element to community water. Professor of Philosophy John Harris successfully argues the ethics of community water fluoridation stating, “The issue of the ethics of fluoridation seems to me to be both simple and straightforward. The issue depends on establishing that fluoridation is both harmless and beneficial. Relying on evidence from a number of sources, there is no reason to suppose that fluoridation of the public water supply, to the level of one part per million that is envisaged, is anything but safe.”⁴⁷

Harris argues the civil rights of water fluoridation by stating, “In short, not all constraints on free choice are constraints on liberty. Citizens living in a community that adds fluoride to their water are no less free than those living in a community that does not.”⁴⁷

Global Programs

FLUORIDES

Fluoride is considered one of the most effective anticaries methods developed to date. Fluoride is being widely used on a global scale, with much benefit. More than 500 million people use fluoridated toothpaste, about 210 million people benefit from fluoridated water, some 40 million people benefit from fluoridated salt, whereas other forms of fluoride applications are administered to about 60 million people.⁴ Several national and international organizations and governments are in favor of water fluoridation where it is practical. In areas where there is no community water source, salt, and milk fluoride programs are promoted.⁴⁸⁻⁵¹ However, populations in many developing countries do not have access to fluoride for prevention of dental caries for practical or economic reasons.⁴

Community Water Fluoridation Worldwide. Water fluoridation has proved safe and effective in worldwide research conducted for more than 60 years. Currently, 39 countries worldwide provide artificially fluoridated water supplies, serving millions of people. In addition, about 40 million individuals drink naturally fluoridated water. Australia, Canada, Israel, New Zealand, Singapore, Spain, Switzerland, and the United Kingdom are a few countries that provide community water fluoridation. In New Zealand, 57% of the population has access to fluoridated water through community water supplies; in Israel, 50%. Approximately two-thirds of the Australian population resides in communities that fluoridate community water. Mandatory legislation requiring all water systems to fluoridate was enacted in South Africa, and Israel requires all cities with more than 5,000 residents to provide fluoride in the water.⁴⁸ About 10% of the UK population receives fluoridated water.⁵¹

Federation Dentaire International, or World Dental Federation, with representation from Belgium, France, Germany, Israel, Latvia, Netherlands, Spain, Sweden, United Kingdom, and the United States, amended their Fluoride Position Statement as follows: “Fluoridation of water supplies, where possible, remains the most effective public health measure for the prevention and treatment of dental decay.”⁴⁸ The National Alliance for Equity Dental Health, composed of 75 organizations, is coordinated by the British Fluoridation Society, the British Dental Association, and the British Medical Association. The Alliance, committed to reducing health inequalities, concluded that water fluoridation is the “great equalizer.”^{50,51} This means that everyone, regardless of age, race, or socioeconomic position, can access community water fluoridation as a preventive agent.

The WHO, in support of water fluoridation, has set requirements for its use:

- Areas with moderate or high risk of dental caries.
- Areas where the economy can support it and the technology is available.
- Areas where water supplies are well organized, used by the public, and appropriately funded.
- Equipment in the water plant should be of a high standard.
- Fluoride chemicals should be available and trained personnel should be available to manage the system.⁵²

In addition, the WHO made the following recommendations for future water fluoridation:

- It should be maintained and expanded where feasible.
- The fluoride levels in the water should be continuously monitored.
- Further research is needed to examine the appropriate fluoride levels in water, taking account of other sources of fluoride and changing patterns of water consumption.

Fluoridated Bottled Water. The rise in consumption of bottled water plays a role in community water fluoridation. As more people,

especially children, are consuming bottled water, community water fluoridation has less impact on the greater population. However, those who need fluoride the most, the poor, may not consume as much bottled water. Also, companies are optimizing the fluoride in their bottled water to give consumers a choice. Health conscious parents have a choice to give their children bottled water with or without fluoride levels optimized. Bottled water with fluoride added can be readily purchased at most grocery stores.

School Water Fluoridation. Other fluoride programs have been attempted with less success than community water fluoridation. One such alternative to community water fluoridation is fluoridating a school’s water supply system. This method can be used if the school has a stand-alone water system that is not connected to the community water supply. Because children are only at school part of each weekday, the recommended concentration is 4.5 times the optimal concentration for a community system.⁵³

School water fluoridation systems present several concerns. Maintaining school systems that are smaller than typical community fluoridation systems creates difficulties, which can result in higher than recommended fluoride concentrations in the drinking water. Although these higher concentrations present reason for concern, they have not resulted in lasting effects among children.⁵³

Fluoride Rinse Programs. Approximately 3 million children in the United States participated in school-based fluoride mouth rinsing programs during the 1980s. A study conducted by the National Preventive Dentistry Demonstration Program reported that these fluoride mouth rinses had little effect among schoolchildren, either among first-grade students with high and low caries experience or among all second- and fifth-grade students.⁵⁴

Fluoride rinse programs implemented through school programs have demonstrated limited success. The school programs depend on teacher and/or school nurse compliance and individual parental consent. The teacher must set aside time for students to participate in the rinse program.⁵⁴ In addition, individual consent by parents

often results in children at high risk for caries not being included in the program. Therefore, it is difficult for a school rinse program to truly target the children who could benefit most.

Fluoride Varnish. Fluoride varnish programs are being implemented as community health programs to assist in reducing the incidence of dental caries, particularly in the very young. High-concentration fluoride varnish is painted directly onto the teeth. The varnish is not intended to adhere permanently. Instead, it holds a high concentration of fluoride in contact with the teeth for several hours. Fluoride varnish has several advantages, including ease of application, a nonoffensive taste, and use of smaller amounts of fluoride than required for gel applications. Fluoride varnish is considered the most effective professional fluoride treatment for primary caries.⁵⁵

Fluoride varnish has been widely used in Canada and Europe since the 1970s to prevent dental caries. The Food and Drug Administration's Center for Devices and Radiological Health has not approved fluoride varnish as an anticaries agent, but lists it as a medical device to be used as a cavity liner and root desensitizer. The CDC states that "Caries prevention is regarded as a drug claim and companies would be required to submit appropriate clinical trial evidence for review before this product could be marketed as an anticaries agent."⁵³ However, a prescribing practitioner can use fluoride varnish for caries prevention as an "off-label" use, based on professional judgment."⁵⁶

Fluoride varnish programs appear to be most effective when integrated into an existing program such as Women, Infants, and Children (WIC) or Head Start or well-child checkups with a trained health care professional. The Nevada Healthy Smile, Happy Child program has developed training materials for health professionals to start a fluoride varnish program.⁵⁵

Salt Fluoridation. Salt fluoridation is an alternative in areas where water fluoridation is not possible. France, Germany, Switzerland, and certain South American countries use salt fluoridation. The recommended concentration is

400 mg/kg of salt. The WHO has established the following criteria for salt fluoridation:

- Where water fluoridation is not possible
- Where there are low levels of fluoride
- Where the political will to introduce water fluoridation is absent
- Where there is a centralized salt production with strong technical support.
- Additionally, appropriate labeling of the salt packages is essential.⁵²

Milk Fluoridation. Milk fluoridation delivered through school-based programs has proven to effectively reduce caries in children. In spite of its efficacy, milk fluoridation is limited as an oral health promotion intervention.⁵⁶ Milk is difficult to deliver, as it must be continuously refrigerated.

Fluoride Tablets. Fluoride tablets were originally designed to be dissolved in water and given to a child throughout the day. Eventually, the pill-oriented society evolved into giving a tablet to be chewed up and swallowed once a day. Currently, several countries have established recommended dosage schedules for fluoride tablets. These dosage schedules differ among countries, but all are based on assessing risk factors for dental caries for the individual person.

TOBACCO PREVENTION

Tobacco prevention is a global oral health promotion program established by the WHO. Each year the WHO identifies one day as World No Tobacco Day. This effort is an attempt to encourage those who smoke to quit and those who do not to stay tobacco free. "This yearly celebration informs the public on the dangers of using tobacco, the business practices of tobacco companies, what WHO is doing to fight the tobacco epidemic, and what people around the world can do to claim their right to health and healthy living and to protect future generations."⁵⁷

World Tobacco Day, established in 1987 is an example of an effective collaborative health prevention effort that focused on educating the public about the diseases that using the

substance can cause. The WHO has selected a topic or themes each year to combat the use of tobacco. Example of previous themes include Tobacco: Deadly in Any Form or Disguise, Tobacco Free Film, Tobacco Free Fashion, and Tobacco Free Sports. Campaign materials such as interactive web sites, publications, videos, a site to register your local activity, and press releases for the public and professionals are produced.

XYLITOL

Xylitol is a five-carbon sugar alcohol used in many foods and snack items. It prevents *Mutans Streptococci* from metabolizing other sugars and inhibits enamel demineralization. It is an important method of dental caries control in many countries, including Finland, where it is distributed with college lunches and in military survival packs.

RECOMMENDATIONS FOR THE FUTURE

The world is changing more rapidly than ever before. It is estimated that the population will be much more culturally diverse in the near future. These changes bring new challenges to those working to promote health and prevent diseases. Oral health professionals must provide culturally appropriate services in a cost-effective manner.

The major challenges to the future will be to translate knowledge and experiences of disease prevention into action programs.⁴ This will require the use of technology, development of an appropriate professional workforce, and use of evidence-based interventions.

Using Technology

Technology can be used to meet the growing need for preventive and educational services.^{58,59} The Internet was used during the terrorist attacks of September 11, 2001, and in ensuing events, as an educational tool for health care providers. Information was available in a matter of minutes for those providing health services to injured or

sick individuals. Previous dissemination of health information to a broad audience took days or even months; the Internet can deliver information in a matter of hours. One proactive web site is the CDC home page. This resource should be expanded and health care professionals should be taught, as a regular part of their education, to evaluate web sites as sources for scientific information. More information on evaluating Internet content is described in Chapter 15.

The Internet can also be used in training health care providers to (i) deliver oral health promotion, (ii) present continuing education in rural communities, and (iii) provide opportunities for dental hygienists to complete their bachelor's or higher degree. For example, some schools offer a bachelor's degree completion program that is delivered completely online. Practicing professionals can stay in their hometown when taking courses. This is especially beneficial for rural communities that have a shortage of health providers and limited access to educational opportunities.

The Internet can also be used in creative ways to provide educational programs through community centers, schools, and public libraries. Technology can be used when face-to-face interventions are impractical.⁶⁰ Today's children expect to use interactive software, web sites, and games as a part of everyday life. Oral health education software can be developed and distributed to schools and after-school programs. Games that are based on eliminating the "tooth bug" and conquering tooth decay can be fun and educational.

Teledentistry is another use of technology that enhances patient services, promotes community health and improves access to specialists. It is being used with increasing frequency by oral health professionals in rural areas to increase access to care. Teledentistry allows patient data including, radiographs, photographs, and progress notes to be transmitted synchronous or asynchronous from one provider to another provider practicing in a different area of the state or country. Patients living in rural areas may have access to a general dentist and a dental hygienist, but when more complex oral health issues arise they

cannot reach a specialist. This means of technology can be used to make diagnoses or treatment recommendations without the provider being in the immediate area. This is particularly useful for patient living in rural or remote areas where transportation or travel is difficult. Teledentistry is also being explored for its potential as an educational tool for patients.

Oral Health Professional Workforce

The burden of need for effective oral health promotion initiatives can be reduced by better use of oral health professionals. One example is developing alternative models of care by using nondentist oral health care providers as described in Chapter 3. Most dental hygienists are competent to place pit and fissure sealants, as well as evaluate the need for such sealants. However, many dental practice acts do not allow the placement of sealants without the supervision of a dentist. Few board certified public health dentists and fewer dentists in private practice can take time away from their practice to supervise dental hygienists outside of private practice.

A second example was revealed in a systematic review of oral cancer screening programs. The authors concluded that there is a need for other health care providers to assume more responsibility to ensure that the public receives oral cancer examinations.⁶¹

The Task Force on Community Preventive Services was charged with determining interventions to promote and improve oral health. The Task Force determined that it is time to for dentists and politicians to think seriously about educating other oral health professionals who encounter populations at high risk for oral disease.⁶⁰ Increased use of other oral health care providers, in many cases, requires educating politicians. Politicians must understand the need for more oral health professionals who will provide care to those with health disparities. To bring about policy changes and amend practice acts, public health professionals must be actively involved in educating state representatives. Politicians should be continuously

informed of emerging data on oral health, oral health interventions, and qualifications of personnel.

Health Information Literacy

Health information literacy must be a standard part of all oral health promotion interventions and educational programs.^{62–64} **Health information literacy** is the set of abilities needed to recognize a health information need; identify likely information sources and use them to retrieve relevant information; assess the quality of the information and its applicability to a specific situation; and analyze, understand, and use the information to make good health decisions.

To promote more health information literacy in oral health promotion, Congress authorized the Health Promotion and Disease Prevention Research Centers Program, administered by the CDC. The program's key features are multidisciplinary faculty, knowledge of community needs, and collaboration with new and traditional health partners. The 26 centers involved focus on reducing priority health risks and promoting health behaviors.⁶⁵

Summary

Oral health promotion, the process of enabling people to increase control over and to improve their health, is directed at four preventable oral diseases—dental caries, diseases of the supporting structures, oral pharyngeal cancers, and sports-related craniofacial injuries. Prevention or stopping disease before it occurs or in its early stages is central to health promotion. Amelioration of health inequities also is essential as the poor, minorities, and elderly share a disproportionate amount of preventable oral disease. The primary goal of oral health promotion is to reduce the prevalence of oral disease through education and other interventions.

Professionals abide by a rule or code of ethics that promotes health for the public. Current statistics clearly reveal that oral disease is one of the most prevalent health problems

in society. As community members and as health care providers, we have a responsibility to be involved in health promotion to address this issue. The oral health professional can be involved in oral health promotion and help meet the objectives of Healthy People by resolving to influence social change, implement community programs, and work with existing effective programs.

Learning Activities

1. Go to the Centers for Disease Control and Prevention Web page (<http://www.cdc.gov>) to read about health disparities related to dental caries and water fluoridation.
 - a. Which populations have the greatest proportion of dental caries?
 - b. What does the Surgeon General say about community water fluoridation?
2. Go to the Healthy People 2020 web page. Write a paper discussing what progress has been made in the area of oral health promotion due to the objectives in Healthy People. Discuss where you think more emphasis is needed.
3. Interview an uninsured member of a population that is at greater risk of dental caries and who has experienced a toothache.
 - a. Ask them about their frustration in accessing dental care when they were in pain.
 - b. What steps did they have to go through to receive dental care?
4. Conduct an Internet search, using your favorite search engine, to read the opinions of those opposing community water fluoridation. Simply type in water fluoridation, you will find many sites.
 - a. Create a list of reasons for opposing community water fluoridation.
 - b. Describe how you would respond to someone with those views.
5. Write a letter to the editor expressing your support for community water fluoridation.

Use supporting evidence to convince the reading audience of your opinion.
6. Write a letter to the editor expressing your opposition to community water fluoridation. Use supporting evidence to convince the reading audience of your opinion.
7. Write a review of community water fluoridation after conducting a literature search to locate pertinent articles. This paper should be based on scientific research, therefore, it must cite at least ten referenced works. It should include:
 - a. Risks, benefits, and use
 - b. Type of fluoride used
 - c. Who benefits most from community water fluoridation
 - d. Current dose
 - e. Toxic level
 - f. Signs and symptoms of acute and chronic toxicity
8. Learning activity: Go to <http://www.who.int/tobacco/wntd/2008/en/index.html> to find this year's theme and develop an idea for your local World No Tobacco Day.
9. Choose a health promotion topic (e.g., tobacco cessation, community water fluoridation, early childhood caries). List the social factors at the micro, meso, and macro levels that would be barriers to success of the program.

Resources

Healthy People: <http://www.healthypeople.gov/>
Governmental Agencies:
<http://www.nidr.nih.gov/>
<http://www.cdc.gov>
<http://www.health.gov>
Fluoride/Fluoridation web sites:
<http://www.cdc.gov/oralhealth/topics/fluoridation.htm>
http://www.who.int/water_sanitation_health/publications/fluoride_drinking_water/en/

<http://www.ada.org/public/topics/fluoride/news.asp>

<http://www.bfsweb.org>

Tobacco web sites:

<http://www.who.int/tobacco/en/>

<http://www.cancer.org>

Review Questions

1. Most disparities in oral health fall along lines of:
 - a. age, race/ethnicity, and socioeconomic position.
 - b. age and socioeconomic position.
 - c. age, race/ethnicity, educational level, and gender.
 - d. age, race/ethnicity, gender, and socioeconomic position.
 - e. race/ethnicity, gender, and socioeconomic position.
2. Why is community water fluoridation considered a model for oral health promotion?
 - a. It is safe, effective, and socially equitable.
 - b. It is easy to implement, effective, and inexpensive.
 - c. The CDC recommends it.
 - d. The public is uniformly supportive of fluoridation.
 - e. It is safe, reaches everyone, and is expensive.
3. The primary goal of any oral health program should be to:
 - a. change individual habits.
 - b. educate the public.
 - c. empower people to attain equity in health.
 - d. teach people oral hygiene care.
 - e. provide clinical services.
4. Education should be included in which stages of a community water fluoridation program?
 - a. Community assessment
 - b. Early planning
 - c. Implementation
 - d. Evaluation
 - e. All stages
5. What are three options to community water fluoridation that provide systemic fluoride?
 - a. Professional application of fluoride, salt, and milk fluoridation
 - b. School water, salt, and milk fluoridation
 - c. Fluoride rinse, professional application, fluoride tablets
 - d. Fluoride varnish, school water fluoridation, and fluoride tablets
 - e. Fluoride varnish, salt fluoridation, and fluoride tablets
6. Who benefits from community water fluoridation?
 - a. Small children younger than age 7
 - b. All children younger than age 18
 - c. Adults
 - d. The elderly
 - e. Everyone who has teeth
7. All of the following are examples of primary prevention EXCEPT:
 - a. community water fluoridation.
 - b. pit and fissure sealants.
 - c. preventive education.
 - d. professional fluoride applications.
 - e. remineralization of dental caries.
8. A single educational program is not effective as a health promotion program because:
 - a. individuals learn at different rates.
 - b. health behavior is complex and includes many factors, such as psychosocial issues, health habits, and cultural influence.
 - c. people are difficult to educate in groups.
 - d. everyone has a different learning style.
 - e. educators should be calibrated.
9. It is important for the oral health professional to understand risk factors for oral disease, health behaviors, determinants, and disparities in oral health so they can:
 - a. identify a target audience and design a program specifically for that audience.
 - b. demonstrate compassion for the populations.
 - c. change the risk factors.

- d. change the health behaviors.
- e. explain it to their patients.

10. Social factors operating on a micro level include:
 - a. social institutions.
 - b. the family unit.
 - c. age.
 - d. cultural beliefs.
 - e. government policies.

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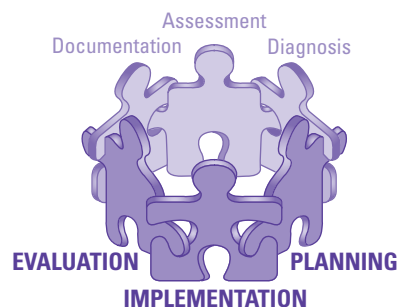
Community Oral Health Education

9

Objectives

After studying this chapter and completing the study questions and activities, the learner will be able to:

- Define health education.
- Describe the goal of health education.
- Describe the traditional, cognitive approach to health education.
- Discuss why the traditional model is not always effective.
- Discuss advancements in health education.
- Give examples of health education in individual and group education settings.
- Define and explain health literacy.
- Describe health behavior theories.
- Discuss components of common theories of health behavior.
- Explain Maslow's Hierarchy of Needs.
- Describe the components of the Learning Ladder Continuum.
- Apply appropriate health behavior theory, motivational and learning concepts, and teaching methods to guide an education effort.



KEY TERMS

Community focus

Community Organization Theory

Compliance

Consumer Information Processing Model

Enabling factors

Focus groups

Health Belief Model

Health education

Interpersonal focus

Intrapersonal focus

Learning Ladder

Learning style

Maslow's Hierarchy of Needs

Oral health education

Organizational Change Theory

Predisposing factors

Reinforcing factors

Social Cognitive Theory

Social Learning Theory

Stages of Change Model

See Appendix 3 for the ADEA competencies addressed in this chapter.¹

Introduction

Dental professionals play a vital role in the health of individuals and of groups. As oral health educators they design, develop, implement, and evaluate oral health education efforts for diverse populations. Theoretic guidance for this aspect of dental hygiene has been borrowed from educational theory, communication, and social and behavioral psychology. This chapter introduces

some basic concepts for guiding oral health education efforts.

HEALTH EDUCATION

Health education provides the decision-making foundations needed to become and stay healthy. Defined as “learning opportunities or educational interventions designed to help individuals or

groups learn new health information and develop new health behaviors,” it is a process of communicating information about evidence-based methods of disease prevention and encouraging responsibility for self-care.^{2,3} Health education services can be directed toward either individuals or groups. They can be developed in different formats and presented in various settings. To be considered successful, health education must result in behavioral change.

The terms *health education* and *health promotion* are sometimes used interchangeably. Both are important in modifying detrimental behaviors and promoting self-wellness concepts. Although the concepts are similar, their differences are significant. The goal of health education is to have a positive impact on health through accurate knowledge of health behaviors and lifestyles. Health promotion, which may include health education, is a broad concept that addresses the general process of advocating health, increasing awareness of health issues, and identifying appropriate strategies to address health issues and prevent disease.⁴

Many health care providers offer health education; it is not restricted to any one profession or field. Dentists and dental hygienists, as well as physicians and nurses, have a key role in health education delivery because the care they provide often includes educational information. Whether working with individual patients in the clinical setting or with groups in a community setting, the dental hygienist is an educator. In the American Dental Hygienists’ Association role of Educator, dental hygienist educators are vital to oral health.

ORAL HEALTH EDUCATION

Oral health education is a planned package of information, learning activities, or experiences intended to produce improved oral health. Its primary goal is disease prevention. Its purpose is to facilitate decision making for oral health practices and encourage appropriate choices in preventive health behaviors. Oral health education has advanced from a traditional, cognitive approach that merely provides health facts to one of incorporating various models of sociology,

psychology, learning styles and methods that better support learning and behavior change.

Historically, many health recommendations have centered on avoidance behaviors, such as “Brush this way ... to avoid periodontal disease” or “Don’t eat sweets ... to avoid dental caries”. Contemporary health education strategies emphasize the positive aspects of health, often using a wellness approach to encourage health achievement.⁵

All health education activities do not produce positive changes in oral health behaviors. Research has shown that simply dispensing information regarding ways to improve oral health, as in the traditional cognitive approach, is ineffective for producing changes in oral health behaviors.² To be successful, an oral health education plan must assess and accommodate the knowledge levels and needs of the intended audience. It should be tailored to incorporate their cultural norms, values, beliefs, attitudes, opinions, and environment. An educational plan should be modified and adjusted as needed to ensure that it is appropriate for the audience.

HEALTH LITERACY

We live in a time when advances in medicine are occurring more rapidly than ever. Yet, people’s adoption of ideal health behaviors for a longer and better life lag far behind medical discoveries. The problem is confirmed by the numbers of people who avoid medical exams for colorectal, cervical, or breast cancer and by the moderate successes of smoking cessation programs.

What is the reason for the difference between the availability of health information and the failure to adopt healthy behaviors? Is it that people do not know how to live healthfully, or that they do not want to know? Do people just not care? One possible answer is that people are unable to understand and act on the health information that is available to them. Investigations into this literacy hypothesis are providing health professionals with new perspectives on an old problem.

Healthy People 2010 described health literacy as “the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make

appropriate health decisions.” In this description, the term capacity refers to the skills of the individual as well as their natural potential. It is affected by education, culture, language, and the characteristics of health settings.⁶

More than just reading skills, health literacy includes such abilities as understanding instructions on a prescription bottle and using medicines safely, asking pertinent questions for information about personal and/or family health, understanding spoken medical and dental recommendations, communicating signs and symptoms to health professionals, and advocating for patient rights in a health setting. It enables adults to use health resources and to make decisions and take actions for their own health.^{7,8}

Health literacy is not necessarily related to the years of formal education a person has completed. It may be significantly lower than one’s general literacy and is impacted by context and setting.⁶ A person may be able to function well at home or at work yet struggle with unfamiliar medical concepts and terminology.^{8,9} Studies show that a lowered level of ability to function effectively in the health care environment is widespread.⁹

An estimated 90 million people in the United States, nearly half of all adults, have limitations with understanding and acting upon health information. Forty million Americans are unable to read and understand the complex text in written informed consents, health insurance policies, and in common health information pieces.⁶

Cause and effect connections between low health literacy and health outcomes are suggested in the literature and support the importance of health literacy. These connections imply that health literacy impacts both the individual’s overall health and the ability of a health care system to deliver cost-effective, quality services.⁸ Research has shown that people with limited health literacy are less likely to understand health instructions well or take medications correctly and less likely to be able to keep chronic health conditions under control. They are less likely to use lower-cost screening and prevention services. People with low health literacy skills are more likely to use expensive health services, such as a hospital emergency room, and are more likely to be hospitalized.⁶

Our health care system is becoming more consumer-centered in an effort to reduce costs and to improve the quality of health care. It is increasingly necessary for people to take an active part in maximizing their own health and making health-related decisions. Strong health information skills and adequate health literacy can assist in meeting that need.¹⁰

Increasingly aware of the ramifications of low health literacy, national organizations are becoming more involved in improving the health literacy of the population. Objective 11.2 of Healthy People 2010, “Improve the health literacy of persons with inadequate or marginal literacy skills,” has been a major force in efforts to close the gaps in capacity for understanding and using health information. Various measures can be implemented to address the problem of low health literacy; health education is always an integral feature.¹¹ Incorporating plain language into health communications, increasing use of nonprint media, and asking questions to verify understanding are three of the measures suggested in Box 9-1.^{9,11,12}

LEVELS OF FOCUS IN HEALTH EDUCATION

Health education may be designed to address the needs of individuals, groups, or entire communities. When developing health education components, it is helpful to work from a conceptual framework that targets, or focuses on, the intended audience. Social and behavioral theories offer a framework that describes three different levels of focus for health activities. **Intrapersonal focus** uses an individual approach to influencing change. **Interpersonal focus** uses social networks to influence change, and **community focus** impacts social, cultural, and political agencies.^{4-6,13}

An intrapersonal approach to health education focuses on the individual as the target of change. It uses behavior modification techniques to effect changes in knowledge, attitudes, or beliefs.⁴ One example is one-to-one chairside instruction on the relationship between plaque and dental diseases. In a health education program with individual focus, the program



BOX 9-1 Strategies for Improving Health Literacy

Establish embarrassment-free environments and open professional relationships.

Use more visuals to communicate information, such as simple sketches, picture books, and videos.

Link new information to something the person already knows.

Verify understanding: through open-ended questioning or having the patient explain information back to you “in their own words.” Ask for a return demonstration of any new behaviors that require psychomotor skill.

Make instructions and other information interactive. Explain the relevance. Give examples.

Repeat information often; emphasize (highlight) important information.

Use simple and clear language and avoid complex technical jargon. Reduce content to what patients really need to know.

Use written materials that are prepared for a fifth grade reading level

Use written patient education materials that have:

- simple words with one or two syllables
- short sentences (with 8–10 words per sentence)
- simple large (12 font) print with a mixture of upper- and lowercase letters
- simple illustrations appropriate for the target audience
- enough “white space” to minimize clutter
- bulleted lists

Adapted from: Andrus M, Roth M. Health literacy: A review. *Pharmacotherapy* 2002;22(3):282–302.⁹

recipients have the ability and resources to start and maintain the desired behavior change on their own.

In contrast, the interpersonal approach focuses on groups as the targets of change. This has been referred to as a “people helping people” approach to health education in which small group strategies between families, neighbors, peers or work groups try to achieve behavioral change. A health education program that focuses on the group as the target of change is based on the belief that interpersonal interactions and characteristics are the forces that initiate and reinforce behavioral change in group members. Group dynamics are a factor in the effectiveness of these educational programs.⁴ An example of this type of program is a chemical dependency support group in which group members give each other reinforcement.

A community approach to health education focuses on the impact of economy, politics, or other factors within the community on behavior. Health education efforts that include decision makers in regulatory or legislative bodies illustrate this level of focus. Community-focused education programs take advantage of community strength to manage problems that cannot be effectively addressed by the individual or small group.⁴ Community organizing and social marketing are examples of change strategies at the community level of focus. Table 9-1 further describes these levels of focus and gives examples.

HEALTH BEHAVIOR THEORIES

Theories from sociology, education, and psychology that describe learning and behavioral change can help oral health educators in designing and

TABLE 9-1 LEVELS OF FOCUS IN HEALTH EDUCATION

APPROACH	OPERATES ON	EXPLANATION	EXAMPLE
Intrapersonal (Within the Individual)	Influences individual knowledge, attitudes, skills, behavior, self-concept, self-esteem; developmental processes	Focuses on the person • Uses behavior modification to effect changes Strategies used: • information dissemination • skill development and repetitive learning experiences • increased cognitive awareness	At chairside, one-to-one instruction on the plaque and dental disease relationship
Interpersonal (People Helping People)	Involves families, work groups, peers, neighbors, social networks, social support	Focuses on interactions between people Strategies used: • individual and small group strategies • peer group influences • counseling in the oral health care setting	Town Hall meeting on community water fluoridation Oral health education workshop for caregivers to special needs patients
Community (Creating Public Policy)	Impacts regulatory agencies, legislation, governmental structures, formal and informal leadership, social, and health services	Focuses on the impact of economy, politics, social, cultural, and environmental factors on oral health behavior Strategies used: • Broad efforts to include decision makers, governmental bodies, and public interest groups	Letter campaigns to legislators about regulations, such as supervision laws, that put limits on access to care for some populations

From Locker D. Preventive Dental Services. 2nd ed. Canada: Health and Welfare, 1988; Darby ML, Walsh MM. Dental Hygiene Theory and Practice, Philadelphia; W.B. Saunders, 1995; and Dignan MB, Carr PA. Program Planning for Health Education and Promotion. 2nd ed. Philadelphia: Lea and Febiger, 1992.^{4,5,13}

developing educational efforts. Some basic theories and principles are presented here.

Theories with Intrapersonal Focus

HEALTH BELIEF MODEL

The **Health Belief Model** is useful in predicting the likelihood of an individual's **compliance** with professional recommendations for preventive health behaviors. Based on experiences with public participation in a screening program for tuberculosis, this model was first introduced in the 1950s by I.M. Rosenstock¹⁴ and other psychologists working with the U.S. Public Health Service. It remains a major construct that is still consulted for understanding behaviors.

This model is based on the theory that behaviors are directed by perceptions and beliefs. It suggests that whether or not a person engages in preventive health actions depends on these beliefs. In short, it provides an outline of the essential factors involved in behavioral change. The belief components of this model are as follows:

- **Susceptibility:** The individual must believe that they are susceptible to a given disease or condition.
- **Severity:** The individual must believe that the disease will have an impact of at least moderate severity, or seriousness, on their life.
- **Beneficial:** The individual must believe that there are effective actions that can be taken to reduce the risk of, or control, the disease.



BOX 9-2 Illustrating the Health Belief Model

Susceptibility	"I could develop periodontitis."
Severity	"Periodontitis is a serious disease and can lead to bleeding gums, bad breath, and tooth loss which will affect my life."
Beneficial	"There are specific things I can do, such as using the recommended brushing method and following the prescribed home care regimens, which will prevent the disease."
Benefits Outweigh Barriers	"It is worth the extra time I spend to clean my teeth and mouth to be free of the threat of periodontitis."

- Benefits outweigh barriers to action: The individual must believe that the benefits of taking the recommended action exceed any difficulties they might encounter.¹⁴

The stronger these beliefs are, the higher the probability that an appropriate health action will be taken. If oral diseases are not perceived as a serious health threat, it is unlikely that a person will participate in daily preventive dental behaviors, proceed with professional interventions, or accept professional recommendations.

Cues to action that activate readiness to change and stimulate overt behavior change are a concept that has been added since the model was first described. The concept of self-efficacy, or confidence in one's ability to successfully perform an action, was added by Rosenstock and others in 1988. It helps this model better fit the challenges of changing unhealthy habitual behaviors, such as overeating, smoking, or sedentary lifestyles.¹⁵

Observations and questioning during assessment give clues to a person's existing health beliefs. Other factors that play a role in modifying beliefs and the potential for compliance with health recommendations are patient demographics (age, gender, race, ethnicity), peer or reference group influences, and prior knowledge about health problems.

The Health Belief Model can be used to help identify leverage points for changing behaviors. It can also be a useful tool when designing change strategies. Developing persuasive health

messages that can guide individuals toward making healthy decisions is one promising application. Box 9-2 illustrates the Health Belief Model.

STAGES OF CHANGE MODEL

The **Stages of Change Model**, introduced by Prochaska and DiClemente in 1979, grew from their work with smoking cessation and drug and alcohol addiction. It has recently been applied to a variety of other health behaviors. This theory is concerned with an individual's readiness to adopt a behavioral change for a healthier life. It views behavior change as a process rather than an event, with people at varying levels of motivation, or readiness to change.¹⁶

The primary concept of this theory is that people cycle through different stages of readiness and that an individual can be in any stage at any given point in time. This is a circular, not a linear model. People can enter or exit the circular cycle at any point and may often recycle through the stages. The oral health educator can use this theory to assess the individual's readiness to make a change and match health education efforts accordingly. The major stages of this model and their explanations are as follows:

- Precontemplation: unaware of the health problem, without any thought of need for change
- Contemplation: aware of a problem and thinking about the possibility of making change



BOX 9-3 Using the Stages of Change Model

For the person who does not know about a particular health problem, provide personalized information that alerts them to its risks and the need for risk-reducing behaviors. Stimulate thinking! Offer activities to foster goal development and formation of concrete action plans. If a change is implemented, provide feedback, ongoing support and reinforcement. To minimize relapsing behaviors, offer suggestions for coping with any difficulties that occur because of the behavior change.

REMEMBER: Anyone who isn't ready to adopt a new behavior today may be ready at a future visit.

- Preparation: making a plan for change
- Action: practicing the behavior
- Maintenance: continuing desired health action
- Relapse: resumption of old behaviors.¹⁶

Observing the patient and listening carefully to responses given to the questions asked during assessment can provide clues about a patient's stage of readiness. Educational efforts that match a person's readiness stage are more likely to result in behavioral change. A major concept in this model is that a person can move through the stages over time. The person who isn't ready to adopt a new behavior this week may be at a different stage, and ready to make a change, the next time you see them. Box 9-3 describes using the Stages of Change Model.

CONSUMER INFORMATION PROCESSING MODEL

The **Consumer Information Processing Model**, which evolved out of the study of human problem solving and information processing, addresses the ways consumers take in and use information in their decision making. It makes

two key assumptions: (i) people are limited in how much information they can acquire, use, and remember, and (ii) people combine bits of information into useable summaries and create decision rules to make faster and easier choices.

James R. Bettman, a marketing theorist, developed one of the best known models of consumer information processing. In it, he describes a cyclical process of information search, choice, use and learning, and feedback for future decisions.¹⁷ The model has been extended to address the information environment and the way it affects how people obtain, process, and use information. The application for health education is that, before people will use health information, it must be available, user-friendly, and thought of as useful and new. Box 9-4 gives an example of the Consumer Information Processing Model.

A major concept in this model is that oral health educators must evaluate the information environment and ensure that the target audience finds the information materials convenient, attractive and easy-to-use.



BOX 9-4 Example of Consumer Information Processing Model

In point-of-purchase (POP) nutrition information programs in grocery stores, information is given in summary form and carefully chosen, useful points are provided (obtain and process information). Labels or stickers with symbols or catch phrases, such as "low fat" or "low calorie," are conveniently shown on shelf tags or the items themselves so it is easy to locate (information search). The most successful POP programs offer information that is new and useful in choosing items with nutritional value, and by not providing information consumers already know, such as labeling all fresh vegetables as "healthy."

Theories with Interpersonal Focus

SOCIAL LEARNING THEORY

The **Social Learning Theory** assumes that people and their environments are continuously interacting. Its basic premise is that people learn through their own experiences and by observing the actions of others.¹⁵ The dominant version of Social Learning Theory, named **Social Cognitive Theory**, was developed by Albert Bandura in the 1970s.¹⁸ It proposes that behaviors are learned in social contexts through direct or vicarious experiences, and through observations of others' behaviors and their results. Reactions to a behavior provide reinforcements, negative or positive, that can perpetuate or terminate a behavioral change.

In this theory, self-efficacy (confidence in one's ability to successfully perform and persist in an action) is the most important factor determining one's effort to change behavior. Greater self-efficacy promotes higher motivation to overcome obstacles, and increases the chances that a behavior will persist over time in the absence of formal supervision.

Modeling and behavior reinforcement are two more concepts in this theory. Modeling is a type of observational learning. It allows people to observe others and see the good or bad consequences of an action. Modeling is most effective when the person being observed is powerful, is respected, or shares common characteristics with the observer. Reinforcement is a response to a behavior that affects the chances of its being repeated. Positive reinforcements increase the chances that a behavior will be repeated. Tangible rewards, as well as praise and encouragement for self-reward, encourage people to establish positive health habits. Extrinsic rewards are often useful motivators for persisting in a behavior, but they do not sustain long-term changes. Use these with caution to avoid developing dependence on the reward to stimulate the behavior. Punishments and the absence of a response are examples of negative reinforcements. Box 9-5 describes using the Social Learning Theory.



BOX 9-5 Using the Social Learning Theory

Design a learning plan that includes people who are important to one another or who may have something in common. Choose interactive learning activities that include actual experience(s). Include opportunities for observation of another person who is performing or participating in the desired behavior. Identify role models; point out the experiences of others. Provide praise, rewards, and incentives as reinforcements to build confidence and foster self-efficacy. Emphasize a person's strengths and capabilities; avoid creating dependency on extrinsic rewards. Minimize negative reinforcements.

Theories with Community Focus

COMMUNITY ORGANIZATION THEORY

Identifying common problems, developing and implementing methods for reaching goals that have been collectively set, and activating resources are the constructs upon which the **Community Organization Theory** is built (Box 9-6).¹⁹ It emphasizes active participation and the development of communities to evaluate and solve health and social problems. In contrast to professionally designed and implemented activities, this is a process of self-led improvement within the group. The community (or group) is the medium for change. In this theory, group members

- participate in, and have ownership of, the change process
- believe that they have control over their lives and the lives of those in their group (empowerment)
- assume responsibility for, and take leadership roles in, change
- effectively collaborate to identify problems, achieve consensus on goals and priorities, and implement actions.¹⁹



BOX 9-6 Illustrating the Community Organization Theory

A group of mothers who use the same day care facility for their young children meet regularly to discuss parenting and childcare. They have all noticed the recent occurrence of brown cavity spots on many of their toddlers' upper front teeth. They ask an acquaintance who is a dental hygienist to meet with them to discuss pediatric oral health. After learning about Early Childhood Caries, the mothers ask about naptime routines at the facility and learn that the children are given bottles at naptime. The mothers explain the oral problems associated with this routine to the daycare staff. They work together to modify naptime behaviors and eliminate nursing bottle sugar exposures. In later meetings with the staff, the oral hygiene procedures that are being used at home are described. Successes and challenges are discussed, with the group offering each other support and suggestions for further improvement.

DIFFUSION OF INNOVATIONS THEORY

Before new ideas, behaviors, products, or services become part of society, they must be communicated, accepted, and adopted. The Diffusion of Innovations Theory, introduced in Chapter 2, describes how new ideas, social practices, or products spread through and between societies helps us understand how this happens. The theory was pioneered by Rogers in 1962 to describe the acceptance of a hardier corn variety by Midwest farmers in a depression-era rural society. It is general enough to be useful in addressing many contemporary public health challenges, such as disseminating new early detection and treatment methods, or new disease prevention ideas. It is general enough to be helpful in increasing utilization of beneficial programs.²⁰

How well an innovation is received, or how quickly it is accepted and adopted, is determined by several factors. Involving the target population in innovation development is critical. Their values, needs, experiences, and habits are important considerations. This theory also suggests that it is important to identify community opinion leaders and to gain their support for new ideas and experiences. When a community leader restates information that has been provided through the mass media, the chances that people will accept a new idea or practice are increased.

Another important aspect of this theory is that it views communication as a two-way process. Instead of one person or group persuading a targeted population to accept or adopt an idea, communication flows reciprocally in two directions. When applying this theory, all formal and informal communication channels and social systems should be identified and used to disseminate new knowledge. This theory will be explored in Chapter 15 relating to scientific literature and innovations. Box 9-7 describes using the Diffusion of Innovations Theory.

Not all community members will adopt or even accept new ideas. For those that do, adoption occurs at varying rates and within the category descriptions shown in Table 9-2. Determining where group members are on the adopter curve helps health educators select the best intervention strategies to use for individuals within a particular category.²

Various factors increase acceptance and adoption of a new idea, behavior, product, or service innovation. The characteristics that improve chances of adoption include

- relative advantage (is it superior to a past idea?)
- compatibility (is it consistent with the adopters' experiences and values?)
- complexity (ease of use)



BOX 9-7 Using the Diffusion of Innovations Theory

Identify the values, needs, habits, and experiences of the target population. Modify or adapt the “new thing or new idea” so that it is consistent with these and can be presented in an acceptable context. Identify opinion leaders and ask for their support; ask yourself: who are the influential community members that are likely to be early adopters of the innovation? Involve the group in developing and providing feedback on the new idea. Use media to expose the group to the innovation. Flyers and other types of community announcements at social, recreational, or church events can be effective. Use public service announcements and press releases. Include opportunities for trial experiences (such as free samples). Create activities that allow people to see and understand possible advantages for accepting the innovation.

- trialability (can it be experimented with, or tried on a limited basis?)
- observability (the visibility of successful tangible results).¹⁵

ORGANIZATIONAL CHANGE THEORY

The **Organizational Change Theory** is applied to improve the problem-solving and renewal processes of large organizations or entire communities. Its premise is that organizations move

through stages, or a series of steps, as they initiate and adopt changes.²¹ By recognizing the stages, strategies to promote change can be developed to match various points in the process of change. These four stages are as follows:

- Defining the problem: recognize and analyze problems; seek and evaluate solutions
- Initiating action: formulate policies and directives; allocate resources
- Implementing change: put the change into action

TABLE 9-2 RATE OF ACCEPTANCE OF CHANGE

Innovators	2.5% of population	May be viewed as mavericks; eager risk-takers; alert to the national media; more educated; usually not a part of the prevailing social structure
Early Adopters	13.5% of population	Respected, knowledgeable opinion leaders within the community; active in the community; alert to the national media; use innovations successfully; can be consulted before a potential adopter will accept a new idea
Early Majority	34% of population	Accept change, though not the first; are followers rather than leaders; more educated; more influenced by interpersonal interactions than media; more alert to local and regional media than national; above average age
Late Majority	34% of population	Skeptical members of the community; cautious but can be convinced by peer persuasion; not willing to take many risks; older, less educated and lower in socioeconomic position
Laggards	16% of population	Suspicious of innovations; very slow to change; often oriented toward past; usually have little influence on prevailing social structure; lower socioeconomic position and often feel alienated from society; use media primarily for entertainment. This group is a likely potential target for government-sponsored oral health programs.

Note: There is a small segment of the community that will not accept an innovation.

From DeBiase CB. Dental Hygiene in Review. Baltimore: Lippincott Williams and Wilkins, 2001.²



BOX 9-8 Illustrating the Organizational Change Theory

The oral health educator for a military installation notices that the majority of manual toothbrushes offered for sale at the Post Exchange (PX) store are poorly designed, low quality brushes with design features that might be damaging to oral structures.

The educator asks the manager of the PX to include brushes of recognized quality in addition to those already offered for sale and quickly learns that initiating a change in any military operation is comparable to “moving a mountain.” Specific brands of brushes are selected, priced, and advertised for sale. Once stocked and offered, shoppers begin to make choices from the new stock. Eventually, shoppers begin to request a larger selection of oral health items and self-care devices, as well as power brushes. Because the oral health educator and the PX manager collaborated, and consumers complied, the new store policies for oral hygiene supplies became SOP (Standard Operating Procedure) and an institution was changed!

- Institutionalizing change: the new policy of change becomes integrated into the organization.²²

For organizational change to be complete, new policies must become entrenched within the organization as new goals and values are internalized. Box 9-8 illustrates the Organizational Change Theory.

Table 9-3 summarizes the theories and key concepts that have been presented.

SOCIAL MARKETING

Kotler and Andreasen discuss social marketing techniques and describe ways to apply commercial marketing principles to education program development.²² A marketing mix of the “four Ps” summarizes the formula for marketing success: product, place, promotion, and price. The formula advocates promoting a product, making it available at the right place, and at the right cost. In health education, the product is an educational program that has been developed for the needs and interests of the target population. Promotion refers to the strategies used to make it familiar, acceptable, and desirable. Place refers to the logistics of accessing the program, its availability and distribution. Price refers to the time, money, or energy costs of participating in the program.⁵

A social marketing strategy may include **focus groups**, a marketing technique for understand-

ing consumer behavior. This technique can be a useful tool for collecting information on community needs, attitudes, norms, and other issues. A focus group usually consists of 6 to 12 people with similar backgrounds who meet for 1 to 2 hours for guided discussion. A moderator leads the discussion, asking a series of questions to stimulate the group’s reactions to various issues. The session may be audiotaped or videotaped for later review and analysis. Generalizations can be inferred to the larger group from which the focus group is drawn. Information collected can be helpful in developing new educational programs.⁴

Campaigns against social behaviors or practices that are not conducive to health (such as substance abuse, drinking and driving, or abusive behaviors) are examples of programs grounded in social marketing theory. Credible organizations with a public image of integrity and accountability are successful social marketers. Box 9-9 illustrates Social Marketing Theory.

PRECEDE-PROCEED MODEL

Green and Kreuter published the PRECEDE-PROCEED planning model for health education and health promotion programs.²³ This model was introduced in Chapter 5 (Fig. 5-4). It is useful because it provides a format for identifying factors related to health problems, behaviors, and program implementation.

TABLE 9-3 SUMMARY OF THEORIES: FOCUS AND KEY CONCEPTS

	THEORY	FOCUS	KEY CONCEPTS
Intrapersonal Level	Health Belief Model	Person's perception of threat of a health problem and their appraisal of recommended behaviors for preventing or managing the problem	Perceived Susceptibility Perceived Severity Perceived Benefits of action Perceived Barriers to action Cues to action Self-Efficacy
	Stages of Change Model	Readiness to change or try to change toward healthy behaviors	Precontemplation Contemplation Preparation Action Maintenance Relapse
	Consumer Information Processing Model	Processing by which consumers acquire and use information in decision making	Information processing Information search Decision rules Information environment
Interpersonal Level	Social Learning Theory	Behavior is explained as a three-way, dynamic reciprocal theory in which personal factors, environmental influences and behavior continually interact	Behavioral capability Reciprocal determinism Expectations of Self-Efficacy Observational learning Reinforcement
Community Level	Community Organization Theory	Active participation and development of communities to better evaluate and solve health and social problems	Empowerment Community Competence Participation and relevance Issue selection Critical consciousness
	Diffusion of Innovations Theory	Addresses how new ideas, products, and social practices spread within a society or from one society to another	Relative advantage Compatibility Complexity Triability Observability
	Organizational Change Theory	Concerns processes and strategies for increasing the chances that healthy policies and programs will be adopted and maintained in formal organizations	Problem definition (awareness) Initiation of action (adoption) Implementation of change Institutionalization of change

Adapted From: Glanz K, Lewis FM, Rimer BK. Theory at a Glance: A Guide for Health Promotion Practice. Bethesda: National Institutes of Health, 1997.¹⁵

PRECEDE refers to **p**redisposing, **r**einforcing, and **e**nabling constructs in **e**cosystem **d**iagnosis and **e**valuation (Box 9-10). This portion of the model considers the behavioral factors that

are relevant to the emergence and occurrence of a health problem.

Three categories of factors (predisposing, enabling, and reinforcing) make it possible to



BOX 9-9 Social Marketing Theory

Product: Tobacco Cessation Campaign

Promotion: Posters, radio, and television public service announcements; free oral cancer screenings by dental professionals

Place: Public schools and libraries; screening booths at local malls

Price: Anxieties and emotional stressors associated with “quitting”; transportation to screening location, time lost from work to attend screening

sort behaviors into segments for program planning. **Predisposing factors** provide the reason behind, or motivation for, a behavior. They include knowledge, beliefs, attitudes, values, cultural mores and folkways, and existing skills. **Enabling factors** include the personal skills and available resources needed to perform a behavior. They enable, or make it possible for, actions to occur. The extent to which their absence will prevent an action from occurring is the key to identifying enabling factors. **Reinforcing factors** provide incentives for repetition or persistence of health behaviors once they have begun. Praise, reassurance, symptom relief, and social support are examples of reinforcing factors.⁴

The ability to classify health behaviors in terms of the factors that predispose their occurrence, give reinforcement for repetition, and enable their expression is useful in program planning. Once categorized, priorities must be identified. Priority is assigned to factors on the basis of their importance in effecting the desired behavior, the degree to which the factor can be changed, and the resources available to address the causative factor(s). Priority factors provide the basis for developing the objectives that direct the future action of the program.

The PROCEED portion of this planning model involves the administrative and policy components of the planning model. It refers to



BOX 9-10 PRECEDE-PROCEED Model

P Predisposing
R Reinforcing and
E Enabling
C Constructs in
E Ecosystem
D Diagnosis and
E Evaluation

P Political
R Regulatory and
O Organizational
C Constructs that affect
E Educational and
E Environmental
D Development

the **political**, **regulatory** and **organizational** constructs affecting **educational** and **environmental** development (Box 9-10).

MOTIVATION AND LEARNING

Motivation, which can be explained as the *will to act*, is an important factor in learning. Human motivation theory offers several models for understanding the internal and external forces that can move an individual into action. Some useful models are included here.

Maslow's Hierarchy of Needs

Psychologist Abraham H. Maslow combined a large body of research related to human motivation in his conceptualization of a hierarchical arrangement of needs as motivating factors. His work, first published in 1954, has become one of the most popular and most cited theories of human motivation. Oral health educators may find it helpful in identifying motivational factors that can be targeted for facilitating behavioral changes.

Maslow's Hierarchy of Needs suggests that inner forces (needs) drive a person into action and that some needs take precedence over others.²⁴

It provides a framework for identifying, classifying, and assigning priorities to human needs and values. In this concept, needs are classified into a pyramid arrangement according to their importance to the individual, and the importance associated with their satisfaction. Based on their power and strength, the most imperative needs are positioned at the base of the pyramid and the least imperative needs are at the top. The relative importance of each level to the others in the hierarchy is represented by its size within the pyramid. According to Maslow's theory, a person can become concerned about higher level needs only when lower level needs are met; once needs for a level are satisfied, they are no longer motivators. If a situation arises that causes deficits in lower level needs, the drive to satisfy those needs reverts to the predominant motivator. Figure 9-1 illustrates Maslow's arrangement.

The hierarchical arrangement used by Maslow, in ascending order, is as follows:

1. **Physiologic Needs:** These are basic survival needs, and include oxygen, food, water, and rest. This is the dominant and most powerful need level; these needs must be satisfied before any others can become relevant. If not reasonably satisfied, all other categories of needs become irrelevant or are relegated to low priority.
2. **Security and Safety Needs:** This level represents human requirements to be safe from harm and for protection against physical or psychological injury. It includes needs for the stability of a well-organized environment (shelter), economic self-sufficiency (job), protection, and freedom from fear and anxiety. These needs are paramount in times of danger; everything else loses importance. Examples of threats to safety include: war, the loss of parental protection, new tasks, strangers, and illness.
3. **Social Needs:** These are love and social belonging needs (to love and belong). They include needs for affectionate relationships and a place within one's culture, group or family; they are expressed in a desire for face-to-face contacts, intimacy, and a desire to overcome feelings of alienation or aloneness.

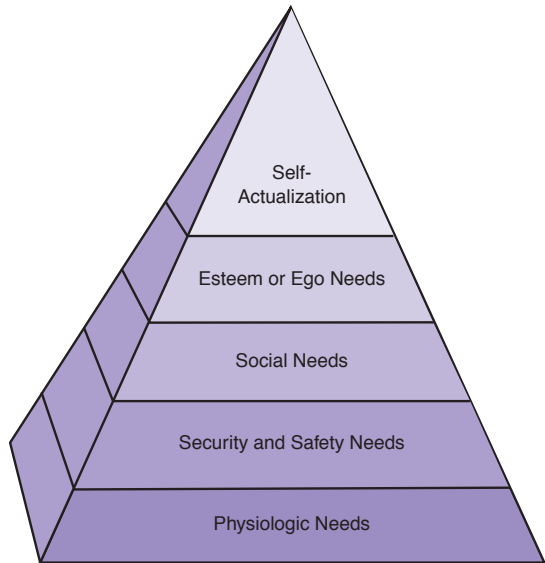


FIGURE 9-1 Maslow's hierarchy of needs.

4. **Esteem or Ego Needs:** This level refers to feelings of self-worth (competence, achievement, mastery, or independence) as well as to the need for gaining the respect (status, esteem) of others. Deprivation leads to feelings of inferiority, helplessness, and discouragement; fulfillment leads to feelings of capability and a willingness to contribute to society.
5. **Self-Actualization or Self-Realization:** This level represents the state of fully achieving one's potential, and the ability to control one's needs rather than being controlled by them. It is achieved as needs to reach the top of one's chosen areas of interests are satisfied.²⁴

Since Maslow's work was first published, materials and goods have become increasingly available to many people while personal concerns about their basic safety and survival have decreased. Generations born after the 1950s have been able to devote more and more energy to esteem and self-fulfillment needs. To mirror these changes in needs, the pyramid configuration morphs. An inverted pyramid shape, as in Figure 9-2, emerges as greater emphasis is placed on fulfillment of higher order needs.²⁵

To apply Maslow's Hierarchy of Needs, the oral health educator identifies where oral health

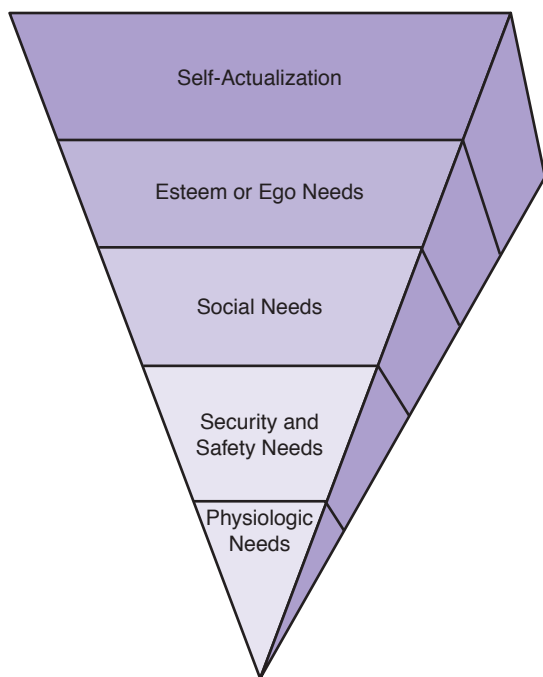


FIGURE 9-2 Inverted pyramid of Maslow's hierarchy of needs. Greater emphasis is placed on higher order needs in the Inverted Pyramid concept of Maslow's hierarchy of needs.

fits into this arrangement for each individual. Certain people may value oral health because they relate to their need for loving human relationships. For them, dental appearance may be important in making friends, getting a job, dating, and sex appeal. For others, a desire for white teeth may be tied in with a need for status within one's culture.

The main point is that identifying and targeting a person's or group's operative needs, and then addressing those needs in an educational plan, may lead to behavioral changes.

The Learning Ladder

The **Learning Ladder**, also known as the Decision-Making Continuum, is based on the concept that people learn in a linear series of sequential steps. It illustrates progress away from ignorance toward acquisition of information and on to the adoption of new behaviors.^{2,26} The learning ladder steps, in sequence from lowest to

highest (shown in Figure 9-3, and explained in Table 9-4), are

- Unawareness
- Awareness
- Interest
- Involvement
- Action
- Habit.

In this theory, the learner must move through each step on the continuum to acquire and make commitment to a new behavior. If a step is omitted, long-term behavior change (habit) will not occur. To apply the theory, the educator identifies the learner's entry level on the continuum and develops a plan for movement up the steps in sequence. An example is given in Box 9-11.

Assessing location on the Learning Ladder Decision-Making Continuum helps educators develop educational plans that address the learner with messages designed specifically for their particular stage of educational readiness.

Learning Styles

Not everyone learns in the same way. A **learning style** is the way one processes information, feels and behaves in learning situations; it describes

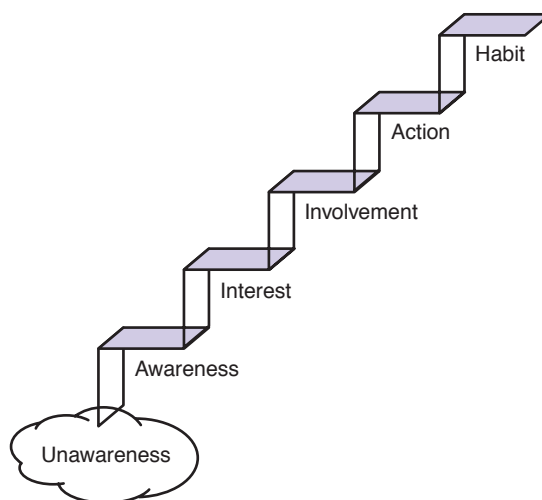


FIGURE 9-3 Learning Ladder Decision-Making Continuum.

TABLE 9-4 LEARNING LADDER DECISION-MAKING CONTINUUM

STEP	EXPLANATION
Unawareness	Ignorance; no information or misinformation • The learner lacks information or has incorrect information about the problem.
Awareness	Receives correct information but has no real sense of personal meaning or desire to act at that time • The learner knows problem can or does exist, but does not act on the knowledge.
Interest	New information becomes meaningful; intrinsic drive ... realizes that the information is relevant to self • The learner recognizes problem and shows a tentative inclination to act.
Involvement	Desire for action: realizes that values are inconsistent with actions, value is strong but behavior is missing, develops urge to act • The learner's attitudes and feelings are affected and the desire for knowledge increases
Action	Moves to act to test the new concepts and practices • The learner implements new behaviors aimed at solving the problem.
Habit	Balances values and behaviors by making permanent changes that produce a lifelong habit • The learner practices new behaviors over time that become part of the lifestyle.

From Harris NO, Christen AG. Primary Preventive Dentistry. 4th ed. Stanford: Appleton and Lange, 1995; DeBiase CB. Dental Hygiene in Review. Baltimore: Lippincott Williams and Wilkins, 2001.^{2,25}



BOX 9-11 Learning Ladder Example

- Expectant parents have no knowledge of Early Childhood Caries (Unawareness).
- They receive information on Early Childhood Caries at prenatal class (Awareness).
- While participating in predelivery discussions that include pictures and diagrams, they realize the implications of using a bottle with formula or sugary liquid when putting a baby to bed (Interest).
- Before delivery, expectant parents role-play desirable bedtime behaviors (Involvement).
- At their new baby's bedtime, parents gently clean the infant's mouth with a damp cloth and offer water at bedtime (Action).
- Gratification derived from providing appropriate infant oral care over time produces lifelong habit (Habit).

how the person learns.²⁷ Understanding the way someone learns helps coordinate teaching strategies with learning styles. Ideally, health education programs will use educational strategies that match the predominant learning style of the target audience.

Certain people are self-learners who learn best through solitary study methods, such as reading. They like to be able to read instructions, texts, or other written information to increase their understanding. Many of these learners prefer to work on their own. Others may learn better in group learning situations. They benefit from group activities and from being paired with another person when possible. These people are peer learners.

Auditory learners learn best through listening activities. These learners do well with lectures and discussions. Extraneous noises may be more distracting to them, however. Others are visual learners who learn best when they are exposed to a variety of visual stimuli. For example, color is a powerful visual stimulus. These learners often find it helpful to use different color highlighters or pens as they are reading and taking notes. Visual learners do well with observational

experiences, such as demonstrations. However, they may be more sensitive to visual distractions.

Still others learn best when they have an opportunity to actively participate in hands-on activities and other types of movement-related experiences. These people are kinetic learners. Their potential for learning is maximized when provided with learning situations that allow, or require, them to physically perform a task.

Learning styles determine how much, and how fast, learning occurs. People typically remember 10% of what they read, 20% of what they hear, 30% of what they see, 70% of what they see and hear, and 90% of what they see, hear and do. These percentages demonstrate that the more effective formats for retaining knowledge appear to be hands-on, interactive multimedia formats as compared to simple reading or listening to a message.³

Most groups will be composed of people with an assortment of learning styles. Oral health educators are advised to use a variety of teaching strategies in an effort to reach everyone in the group. This increases the probability that most learners will have the opportunity to learn in at least one way that best matches their learning style.

Learning Principles

A search of the literature that explains how people learn reveals a large collection of teaching methods for learning situations. Several general principles are found repeatedly in the methods that have been described. Oral health education, for an individual or for a group, that is built around these principles is more likely to result in positive outcomes. Some important highlights are as follows:

- Learning is faster and retained longer when the content has meaning, organization, and structure.
- Repetition, review, and reinforcement enhance learning.
- Learning is most effective when many channels of information, or senses, are stimulated.

- People learn by doing; learners need to be actively involved.
- Learner responses should be immediately reinforced.
- There is greater investment and involvement in learning when learners have participated in selection and planning of the learning project.
- For best transfer of learning between settings and situations, behaviors should be learned in the way they will be used.
- Without readiness, learning may be inefficient, impaired, or even harmful.
- Without motivation, there will be no learning. Identify and exploit the motives a person may have for learning, such as desire for recognition, security, new experiences, satisfaction of basic needs or wants.
- Learners will progress only as far as they believe they need to achieve their purposes.²⁶

Teaching Methods

Oral health educators make choices and have options when deciding on a teaching method for oral health messages. You are already familiar with most of the more common methods! Instructional methods that may have particular application in oral health education are discussed in Chapter 10.

Summary

Understanding and accepting the information that is necessary for becoming and staying healthy is essential to the adoption of a preventive oral health behavior. This is the oral health educator's challenge. Other disciplines offer useful health behavior theories that can provide some insight into why human beings behave as they do. Needs, motivations, readiness to learn, and diverse learning styles are among the factors that influence willingness to engage in preventive health behaviors. Familiarity with the theories and models in this chapter prepares dental professionals to better meet the challenges associated with oral health education for individuals and groups.

Learning Activities

1. Collect several examples of oral health education programs from your state dental health department. After reviewing the pieces of the program using the information covered in Module 2, Program Planning and Evaluation, compare your example to criteria for an “ideal” program.
 - a. Analyze one of your program examples. Try to identify which health behavior theory, or theories, have been used in this program’s development.
 - b. Now, determine which of the general learning principles have been applied and incorporated into the program.
2. Borrow copies of the texts or other books that are used to support or deliver the oral health education units in your local community’s school curricula. How do these materials contribute to the health literacy levels of your community’s population? Which of these materials are, in your opinion, most likely to create behavioral changes toward preventive health behaviors, and why?

Resources

NIH publication, Theory at a Glance: A Guide for Health Promotion Practice, by Karen Glanz and B.K. Rimer is available online at <http://www.cancer.gov/PDF/481f5d53-63df-41bc-bfaf-5aa48ee1da4d/TAAG3.pdf>. Accessed: April 2009

Patient Education Workshop Online—Video
Online tutorial with four modules

- patient education models, learning styles and teaching tools
- the role of creativity in teaching and learning
- teaching skills in practice, teaching tips
- readability tests and suggestions to help in the selection of written materials

Available at: http://library.med.utah.edu/Patient_Ed/. Accessed April 2009.

Review Questions

1. A person who has successfully completed a health education experience
 - a. will not get any new cavities for the next 18 month period
 - b. can correctly describe flossing techniques
 - c. answers five out of seven oral health questions correctly
 - d. practices new oral health behaviors regularly
2. Precontemplation, contemplation, preparation, action, maintenance, and relapse are components of which of the following theories, or models?
 - a. Health Belief Model
 - b. Stages of Change Model
 - c. Diffusion of Innovations Theory
 - d. Community Organization Theory
3. Which of the following is/are correct about a focus group? More than one may apply.
 - a. 6 to 12 people with similar backgrounds
 - b. moderator led guided discussion
 - c. useful tool for collecting information on community needs, attitudes, norms
 - d. inferences can be made for the larger group
 - e. all of the above
4. According to Maslow, a well-organized environment, economic self-sufficiency, familiar surroundings, tasks, and activities are
 - a. physiologic needs
 - b. ego or esteem needs
 - c. social needs
 - d. security and safety needs
 - e. self-fulfillment needs
5. Learning occurs as a series of sequential linear steps from unawareness to habit. This describes
 - a. Stages of Change Model
 - b. Learning Ladder
 - c. Learning styles
 - d. Learning principles

6. Trialability affects the acceptance and adoption of a new product, idea, or innovation.
 - a. True
 - b. False
7. For a health education program, the oral health educator chose brochures that presented only one main point each, and were easy to handle and manipulate. These educational materials demonstrate principles from
 - a. Health Belief Model
 - b. Social Marketing Theory
 - c. Consumer Information Processing Model
 - d. Social Learning Theory
8. Learning is most effective when many channels of information or senses are stimulated. Learners should be actively involved.
 - a. Both statements are correct.
 - b. The first statement is correct, but the second statement is incorrect.
 - c. The first statement is incorrect, but the second statement is correct.
 - d. Neither statement is correct.
9. Which of the following best illustrates the concept of health literacy?
 - a. Your patient tells you that she reads well.
 - b. The subjects in your clinical research project are able to understand and use the instructions they were given.
 - c. 55 of the 60 people in the random sample have completed the 12th grade.
 - d. All of the patients seen in the dental hygiene clinic receive toothpaste at the end of the appointment.
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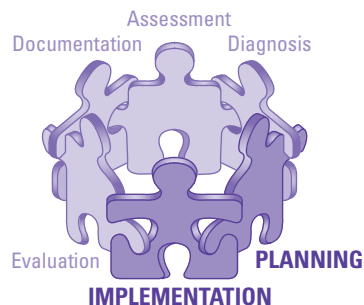
Developing Educational Materials

10

Objectives

After studying this chapter and completing the study questions and activities, the learner will be able to:

- Design health education materials for a target audience.
- Apply plain language principles in the development of educational materials and activities.
- Develop a lesson plan.
- Select instructional media to augment and enhance oral health presentations.
- Discuss options for teaching methods and evaluate each for learning principles applied.
- Evaluate the effectiveness of existing health educational material and methods.
- Create culturally sensitive educational materials.



KEY TERMS

Body

Closure

Educational goal

Instructional media

Instructional objectives

Instructional planning

Instructional set

Layout

Lesson plan

Readability

Subject content

Target audience

Type fonts

Type size

See Appendix 3 for the ADEA competencies addressed in this chapter.¹

Introduction

Techniques for creating experiences that lead to learning have been used and refined by generations of educators. Understanding the processes involved can help dental professionals plan and develop better and more successful oral health education interventions. This chapter introduces the instructional process. Educational materials for oral health education are discussed and described. Applying the information in this chapter will assist in development of new educational materials and in evaluation of existing materials.

INSTRUCTIONAL PLANNING

A meaningful learning experience is the carefully crafted result of a deliberate process known as

instructional planning. In addition to subject matter expertise, **instructional planning** requires an understanding of learning principles and teaching techniques as well as information about the background and learning levels of the intended audience. In oral health education, its purpose is to produce an appropriately tailored oral health educational plan for specific learners.

Instructional planning is a systematic series of equally important events in the design and development of an educational plan. It is a purposeful, learner-centered activity that includes

- analysis of the **target audience** and their unique learning needs.
- identification of learning objectives that define the quality and extent of the learning to be achieved.

- identification of specific subject content to meet those needs.
- selection of methods to deliver that content.
- selection of materials and learning activities to support the learning experience.

Target Audiences

Chapter 6, Planning for Community Programs, discussed the importance and use of the community profile in planning and developing successful community health programs. This information, which is collected as part of community assessment, has instructional planning applications as well. Population demographics are core considerations when planning learning experiences. Age, gender, ethnicity, cultural background, socioeconomic position, and educational levels all influence attitudes, values, and readiness to learn. It is necessary to accommodate these characteristics to make learning experiences meaningful and motivating for those who receive them. Ignoring the significance of cultural influences on values, beliefs, and attitudes can result in a failed experience. Some general guidelines for communicating effectively across cultures are discussed at the end of this chapter.

Learning Needs

The types and kinds of learning outcomes to be effected should be identified early in the planning process. Instructional methods and materials are chosen by how well they support the intended learning outcomes. Do the learners need to know something that they did not *know* before (i.e., facts or *cognitive information*)? Lecture might be an appropriate method for delivering a lesson that puts heavy emphasis on facts and the delivery of factual content.

Do the learners need to be able to *do* something that they could not do before (i.e., skills, or *psychomotor abilities*)? A demonstration showing the skills being performed correctly by someone who already has those skills may be the most appropriate method in this situation.

Do the learners need to be able to think differently about something than they could before (i.e., develop or modify attitudes, or *affective condi-*

tions)? Discussion, which has been shown to be an effective strategy for dealing with attitudes, might be the method chosen. Instructional methods are covered in more detail later in this chapter.

THE EDUCATIONAL PLAN

An educational plan, known to educators as a **lesson plan**, is a well-organized, written guide for presenting a specific block of instruction. It is an outline of the content to be presented that also specifies the procedures to follow during presentation. Lesson plans ensure that all information and materials needed to meet specific learning goals are presented in the most effective order and supported effectively by carefully chosen instructional materials.

Stability and standardization are two benefits from using lesson plans. When educators follow the same lesson plan each time they deliver the same presentation, it is reasonable to expect consistency of results across time. It is also reasonable to expect different individuals who use the same lesson plan to be able to present the same topic and accomplish the same learning goals. To illustrate the need for this kind of standardization, think of a sealant program in which different teams of oral health educators present background lessons to different groups of first- and second grade children before their sealants are applied. All of the program participants need the same information and values regarding the sealants; the educators must achieve the same learning objectives. One standard lesson plan used by all the educators contributes to this result.

Components

Lesson plans begin with a broad general statement that describes the overall purpose of the block of instruction. This **educational goal** is a nonspecific statement that serves as a foundation on which to develop all subsequent plans.² For example, if the target audience is a group of expectant parents at a prenatal class, the goal statement might be “To increase prospective parents’ awareness of the need for oral hygiene care and good oral health for their children.”

Instructional objectives, in contrast, are specific statements that describe what the learner is expected to be able to do, know, or think differently about once the lesson's content has been presented and mastered. These objectives clearly define the intent of the learning experience by describing a pattern of behavior (or performance) that the learner should be able to demonstrate when the learning experience has been completed successfully.

Meaningful instructional objectives that are written in behavioral terms have several components. They are constructed according to the following performance–condition–criteria format.²

1. Identify the behavior (that will be accepted as evidence of learning) by name. Use action verbs to describe what the learner will do (*performance*). Action verbs that are useful in describing behaviors are shown in Box 10-1.
2. Include specific conditions under which the behavior will occur (*condition*). This describes any important or relevant circumstances that accompany the action.
3. Specify a measurable standard that must be met to be considered acceptable (*criteria*). This describes how well the behavior must be performed to provide evidence that learning has occurred.



BOX 10-1 Action Verbs for Behavioral Objectives

KNOWLEDGE (COGNITIVE)	SKILLS (PSYCHOMOTOR)	ATTITUDES (AFFECTIVE)
analyze	act	accept
choose	assemble	adopt
compare	brush	advocate
complete	carry	ask
copy	catch	evaluate
define	climb	promote
describe	demonstrate	question
find	draw	recommend
identify	fit	share
label	floss	volunteer
list	form	
match	manipulate	
name	operate	
place	paint	
plan	perform	
point	prepare	
predict	press	
recall	roll	
select	show	
sort	wipe	
state	wrap	



BOX 10-2 Examples of Instructional Objectives and Their Components

INSTRUCTIONAL OBJECTIVE	P–C–C COMPONENTS	
Using a mirror, adequate lighting and 2 × 2 gauze, the learner should be able to perform an oral self-care exam that exposes all specified oral structures for observation.	Performance	• perform an oral self-exam
	Conditions	• using a mirror, adequate lighting and 2 × 2 gauze
	Criteria	• all specified oral structures
Using a food diary form, the learner should be able to develop a personal 1-week food intake plan that is 90% consistent with healthful dietary concepts.	Performance	• develop a personal food intake plan
	Conditions	• using a food diary form
	Criteria	• 90% consistent

The following examples contain each of the performance–condition–criteria components. They describe exactly what the learner is expected to be able to do and how well the learner is expected to be able to do it after successfully completing the educational experience. For example, (i) “Using a mirror, adequate lighting and a 2×2 gauze, the learner should be able to perform an oral self-exam that exposes all specified oral structures for observation” and (ii) “Using a food diary form, the learner should be able to develop a personal 1-week food intake plan that is 90% consistent with healthful dietary concepts.” Box 10-2 identifies the performance–condition–criteria components of each example.

Objectives for health education interventions often follow a more general approach, specifying only the behavior. The expectation that required conditions are met and satisfactory competency achieved is implied. For example, “The learner will demonstrate disease control in his own mouth through proper daily brushing and flossing for plaque control” may be more appropriate for a health education plan than “Given a quality toothbrush and floss, the learner will demonstrate disease control in his own mouth through daily brushing and flossing to achieve a score of 100% plaque-free surfaces.”

Well-stated instructional objectives guide the selection of lesson content and corresponding presentation strategies. Guesswork is eliminated and random coverage of irrelevant material is

minimized. Instructional objectives also serve as guides for evaluation of learning and the evaluative process. The degree to which learners do or do not achieve expected learning outcomes can serve as a basis for drawing inferences about the effectiveness of the educational intervention.³

Subject content is the main focus of the lesson plan. This portion of the lesson plan addresses the new facts, attitudes, or skills that the learner needs to know. It is the information that has been collected about the topic, researched, and selected for presentation. When the needs assessment phase of community program planning identifies deficiencies in health information or practices, corrections and adjustments can be built into the subject content portion of an educational intervention’s lesson plan.

Subject content information should be organized effectively to fit the time and facilities available. Chronological order is a simple organization and well suited to explanation of processes, procedures, or historic information. Logical order arranges information according to some plan. From cause to effect, from general statements to particulars, and from least important to most important are examples of logical ordering.

PRESENTATION STRATEGIES

Teaching strategies are methods for relating content to the learners. They are typically identified during content development and selected

based on the characteristics of the learners, the learning objectives, and the type of content being delivered. A number of methods are available. Some types of content are better served by specific methods of presentation.

Lecture is a classroom-style presentation that presents information in a direct, logical manner. It is an expert-centered method; the expert breaks down important points and presents factual material to large audiences in a short time. It is one-way communication and is developed almost entirely by the lecturer. The lecture audience sits passively and takes notes. Although it is a common presentation strategy, it may not be the most appropriate choice for all learners and learning situations.

Discussion involves the audience and encourages pooling of their ideas and experiences. It is a

problem-solving or seminar-style teaching strategy and is frequently used in health education. In a discussion, audience members contribute their ideas to develop information and reach conclusions. It is an active process that allows everyone to participate, but it can be dominated by a few people or sidetracked without a competent group facilitator.

Demonstrations are especially effective for lesson plans built around procedures and manipulative tasks. In a demonstration, a person who can already perform the task(s) shows and explains the technique, procedure, or sequence of steps in a process. They are often used as a follow-up strategy to complement an earlier lecture or discussion.^{3,4} Table 10-1 describes and compares some common instructional methods.

TABLE 10-1 INSTRUCTIONAL METHODS

Lecture	Formal informative talk, prepared and organized in advance Leader-centered Easy to use; economical Good for creating awareness of new ideas Can present many facts in a short time Most effective in large groups when time is limited Learners are not actively involved; communication is one-way Poor presentation skills detract from learning Best when complemented with other methods
Discussion	Leader and learners define a problem and interact to find its solution Group activity, learner-centered Often used in health education Leader uses questions to stimulate participation and interaction Two-way communication between participants and with leader Useful for problem solving; fosters reasoning and critical thinking Strong personalities can dominate the discussion Requires competent facilitator to keep interactions on topic
Demonstration	Shows steps in a procedure to allow learner to see actions to be performed Illustrates and reinforces theory content Can be used to complement lecture or discussion Leader needs the skills to perform the task to be demonstrated If more than one demonstrator, should be calibrated for consistency Can be difficult for larger groups to see Requires careful preparation, appropriate equipment and facilities

(continued)

TABLE 10-1 INSTRUCTIONAL METHODS (continued)

Dramatizations, Role-Playing, and Storytelling	Dramatizations: Learner plays a part in scripted play, skit or puppet show Effective for elementary and middle-school age Requires preparation and focus on learning concepts Role-Playing: Learner receives written information on, assumes, and acts out a role in front of learning group Leader guides follow-up discussion on the topic being role-played Effective for middle-school age through adult Useful in problem analysis and solution development Poor learning experience if learner is not an effective role-player Storytelling: Leader tells or reads a story that illustrates the learning concepts Effective for preschool to early elementary school age Helpful in increasing awareness of ideas, attitudes, and behaviors
Collaborative (or Cooperative) Learning aka: Interactive Learning	People work in small groups to develop learning projects Learner-centered; leader facilitates team development and gives feedback Small group peer interaction enhances learning and increased retention Possible conflicts among team members can decrease efficiency or produce poor project outcomes
Problem-Based Learning aka: Inquiry	Learners research narratives of real problems to learn new information and solve problems Learner-centered; leader gives guidelines on the process and serves as facilitator Uses all levels of learning (recall through analysis and synthesis) Produces cognitive and affective outcomes Fosters motivation Can be superficial and unorganized if not complemented with other methods and capable facilitator Limited gains in immediate new knowledge Requires time and committed involvement
Simulation	Opportunities for learners to practice actions or behaviors in safety of a classroom setting Fosters skill development without fear of irreversible outcomes Leader provides constructive feedback Can be used with a wide range of abilities Experience and outcome can have unsatisfactory outcome if learner has high level of anxiety

PRESENTATION STRUCTURE

Good presentation structure is similar to well-known guidelines for public speakers: “Tell them what you are going to tell them—Tell them—Then, tell them what you told them.” There are three basic components for this aspect of the lesson plan: the **instructional set**, content **body**, and **closure**.

The instructional set establishes the climate for the presentation. Its purpose is to make learners

aware of what they are to learn and cause them to want to learn it. Comments that arouse interest in the use and value of the new information are made here to motivate learners and make it real for them. Instructional objectives and procedural aspects for the presentation are given in the instructional set.

The bulk of the lesson information is given in the content body. All of the major learning points are presented here. Oral health educators should be sure that sufficient research and



BOX 10-3 Sample Educational Plan: A

TITLE: “Being a Good Dental Parent”

TARGET GROUP: Prenatal class for expectant parents

ESTIMATED LENGTH: 50 minutes, evening

INSTRUCTIONAL METHOD: Discussion

EDUCATIONAL GOAL: To increase prospective parents’ awareness of the need for dental care and good dental health for their children.

INSTRUCTIONAL OBJECTIVES:

1. State the number of teeth in the primary dentition and in the permanent dentition.
2. Identify the ages when formation of the primary teeth begins, eruption, and exfoliation of primary teeth typically occur, and eruption of permanent teeth typically occurs.
3. Discuss methods for cleaning an infant’s gums.
4. Describe a technique for effective brushing and flossing.
5. Discuss nutrients needed during pregnancy for proper tooth development.
6. Rebut the myth “You lose a tooth for every baby you have.”

INSTRUCTIONAL MATERIALS: Eruption and Exfoliation Chart, brochures illustrating brushing and flossing techniques, handouts: “Dental Myths” and “Being a Good Dental Parent” quiz

LEARNING ACTIVITY: Quiz—“Being a Good Dental Parent” with multiple choice questions about timing of tooth development in utero, eruption and exfoliation, fluoride, etiology of tooth and oral hygiene techniques

Instructional Set: We are all excited about the anticipated arrival of the soon-to-be new family members and have come to this class tonight to discover ways to help them have a healthy life!

Body

1. Distribute quiz and “Dental Myths” handout, one each per couple. Allow ~8 minutes for participants to complete quiz and review myths.
2. Read questions aloud and allow spontaneous responses from the audience. Discuss to highlight and explain:
 - a. Basic dental embryology
 - b. Basic eruption and exfoliation → Point out on Chart
 - c. Oral Hygiene for infants
 - d. Plaque-Sugar-Acid-Tooth Decay relationships
 - e. Basic brushing and flossing techniques → Distribute OH brochures

Closure: We’ve talked a lot about things as tiny as “baby teeth” and how to safeguard them ... to the importance of our children’s teeth to their dental health and overall well-being. We’ve seen that many of the dental myths we may have grown up believing actually have no basis in fact. If you have any other questions that I might be able to help you with, please contact me at the Community Health Center!

preparation has been done for this part of the presentation. No amount of drama or theatrics can make up for content inadequacies or poor sequencing!

The presentation’s closure summarizes the material that has been presented. Main points are reviewed here to give a sense of unity to the lesson as a whole. If time permits, questions



BOX 10-4 Sample Educational Plan: B

TITLE: Sugar Q and A

TARGET GROUP: Fourth Grade Elementary

ESTIMATED LENGTH: 45 minutes

INSTRUCTIONAL METHOD: Discussion

EDUCATIONAL GOAL: To increase students' awareness of the damaging effects of a high sugar diet on teeth and encourage food choices that promote oral health.

INSTRUCTIONAL OBJECTIVES:

1. Explain the "plaque-sugar-acid-tooth decay" chain of events.
2. Identify food package labeling as a source of consumer information on ingredients and nutrient content.
3. Differentiate between "tooth healthy" foods and foods that promote tooth decay.

INSTRUCTIONAL MATERIALS: Plaque Chain; samples of food labels from food cartons, packages and cans; clean food wrappers, bags and packages; pictures of high sugar foods from magazines

LEARNING ACTIVITY: "OK Snacks" game (variation of the Grocery Bag game)

Instructional Set: Think for a minute about all of the things you ate yesterday. Did any of those things have sugar in them? Today we are going to take a close look at sugary foods and the effects they can have on your teeth.

Body

1. Explain food labeling regulations and how ingredients are listed. Give examples and discuss.
NOTE: Break students into small groups of four. Give each group three food labels (one showing sugar at top of list, one without sugar or near end of list, and one somewhere in between).
2. Explain plaque and its etiological role in tooth decay using "plaque chain" concept.
NOTE: Use Plaque Chain Chart; begin with each link covered and reveal as each is discussed.
3. Review and reinforce with "OK Snacks" game.

Closure: Now that we've taken a close look at some of the foods we eat every day, we know we eat more sugary foods than we realize. It is important that we break the "plaque chain."

should be taken from the learners. A closing statement of concluding comments formally closes the block of instruction.^{4,5} Examples of set, body, and closure are shown in the sample educational plans in Box 10-3 and Box 10-4.

LEARNING ACTIVITIES AND MATERIALS

Instructional materials and learning activities support the educational plan. They enliven a presentation and help learners form concepts and internalize information. Only activities and materials

that contribute to desired learning outcomes should be included. They can be used to motivate and increase interest, to reinforce content, to supplement verbal information, or to provide opportunities for learner reinforcements and repetitions. Using multiple activities and learning assessments in an educational plan make it possible to effectively evaluate learning outcomes. "Alerts" that cue the oral health educator to begin an activity or to introduce a particular material at a predetermined point during content delivery should be written into the lesson outline.



BOX 10-5 Examples of Simple Games

Grocery Bag Game

Collect pictures or empty cartons, packages, and cans of various foods. Choose items that are common in the culture and diet of the target audience. Put one half in one grocery bag and one half in another. Label pieces of felt or construction paper with the names of a food group category and place on the floor in a clear area. Place the grocery bags at one end of the game area, well separated from each other. Divide the audience into two groups or teams. Assign a bag to each team. Have each team send one group member at a time to place one of the foods from their bag onto the correct food group label. The first team to finish is the winner. Follow with a discussion of the foods and the category to which the teams have assigned them.

Riddles: “I’m Thinking Of...”

I’m thinking of something that...

- we should do after we eat and before we go to bed. (*brush*)
- is a long string and is used to clean between teeth. (*floss*)
- sticks to our teeth, is invisible, and causes decay. (*plaque*)
- bacteria and sugar make to dissolve tooth enamel. (*acid*)
- is in toothpaste and drinking water to make teeth strong. (*fluoride*)

Activities

Learning activities are experiences that lead to learning. Experimenting, collecting, interviewing, writing, discussing, observing, and demonstrating are some examples. Games and puzzles can add fun to educational experiences and are useful ways to review and reinforce lesson content. Educators often develop their own topic-specific games. The “Grocery Bag Game,” described in Box 10-5 is a classic “homemade” game that allows children to touch and manipulate meaningful objects in support of a health topic. Inexpensive software programs are available and easy to use for developing subject-related crossword puzzles and Word Search games.

Instructional Media

Instructional media is an essential element of effective instruction and contemporary learning experiences. It encompasses all the materials and formats that might be used to augment

instruction and assist in achievement of learning objectives. Media formats range from traditional materials such as chalkboards, handouts, charts, slides, overheads, real objects, and videotape or film, to newer materials and methods such as computers, CDs, DVDs, CD-ROMs, the Internet, podcasts, and interactive video conferencing. Advancements in technology have moved media beyond simple “teaching aids” and into the digital world. Using instructional media to enhance and complement subject content has a positive impact on the learning environment. The many formats available allow oral health educators to create stimulating presentations that can reach an audience with a variety of learning styles.

Professionally prepared materials are available from many sources, such as the American Dental Association, American Dental Hygienists’ Association, the National Dairy Council, and commercial manufacturers. Many oral health product companies offer educational materials. Brochures, pamphlets, activity books, and fact



BOX 10-6 Choosing Instructional Media

Choose materials that:

- are accurate and consistent with the latest scientific information.
- are appropriate to the learning levels of the intended population in vocabulary, difficulty of concepts, and sentence structure.
- have illustrations that are relevant to the reading content, not merely “attention-getters” with little or no relationship to the subject.
- present both sides of controversial issues.
- do not mislead with half-truths or incomplete information or make false claims.
- do not contain exaggerated claims for a product or situation.

Use materials that:

- match the educational and reading levels of the target audience.
- make a constructive contribution to the educational program of the patient, school, or group.
- reinforce information already given verbally.
- use color effectively.

sheets are some common examples. Many of these are free on request or can be purchased or rented at low or reasonable costs. Any item used should have an obvious relationship to the presentation topic and should follow the general guidelines for choosing instructional media in Box 10-6.

Media Design Features

Some basic design features are constant across all media formats and must be considered when choosing and using any media. These affect overall appearance and include color use, visual layout, typography, and readability. Whether materials are professionally prepared and obtained from commercial sources or are created by the educator, all should be evaluated for the following criteria.⁶

COLOR AND CAPTIONING

Color is among the first things noticed about visual materials. It is an important design feature that should be used wisely. Color can be used to attract attention, create moods, and emphasize

important areas. A good general rule for color use is to keep it simple by limiting the number of colors in any one piece. Keep the color scheme to two or three major colors. Contrasting colors, such as dark on light and vice versa, are effective for emphasizing important areas.

There are two families of colors: hot and cool. Cool colors are blues, greens, and purples. These are considered calming colors and thought to evoke a relaxed mood. They have been associated with decreases in circulation and body temperatures. Cool colors are good for front elements, such as shapes and designs, and for backgrounds. Hot colors are reds, oranges, and yellows. These are considered stimulating, energizing, and exciting colors. They have been associated with increased circulation and body temperatures. Hot colors may be useful for calling attention to the most important elements of a design. A background of hot colors might be too intense for an audience.

Color symbolism and emotional connotations vary with culture. For example, in American culture, red means danger, green means go, yellow alerts to caution, and red, white, and blue suggest national patriotism. Seasons and holidays

suggest particular color schemes. Autumn suggests a combination of browns, yellows, greens, and reds. Spring suggests bright greens and pastel colors. Halloween uses orange and black and Valentine's Day uses red and white.

Captions and illustrations gain attention and make the intended audience want to see and learn more. A caption might ask a question (What does fluoride do?) or make a positive statement (Spit tobacco stinks!) using words that are directed to the viewer. Captions should be large enough to be seen and read from anywhere in the viewing area. Illustrations are helpful in quickly communicating ideas. Pictures and photographs, drawings, clipart, and cartoons can all contribute to a topic's meaning and content. One caution is to restrict illustrations to only those related to the topic idea.⁶

LAYOUT

Layout refers to the basic compositional form of visual media. Layout designs that draw the viewer's eye from one point to the next make a learning point more quickly. Balance is a major compositional aspect of layout. It refers to the arrangement of graphics and text to make them easier to assimilate and understand. In visuals, it is best to avoid a top-heavy or lop-sided appearance. Three basic balance designs are radial balance, symmetrical (or formal) balance, and asymmetrical (or informal) balance. They are illustrated in Box 10-7.

Layouts with radial balance have lines or shapes spreading out from a central point or spot. In symmetrically balanced formal designs, graphic, or text elements are evenly distributed from the center. Both sides of an imaginary line through the center of the design are weighted the same. Asymmetrically balanced informal designs have elements that appear to balance even though each side of the arrangement is different. Each side of an imaginary line is different, but equal.⁷

"White space," the open space between the elements in a visual composition, is another important layout feature. It is helpful in breaking learning points into sections to make them less

visually demanding. Other fundamental characteristics to look for in a good layout are emphasis, harmony, and contrast.⁶

- **Emphasis:** The central idea is brought out by effective use of lettering techniques, dominant colors, and white space.
- **Harmony:** All visual elements (e.g., lettering, color, materials) appear to "go together" and create a feeling of unity.
- **Contrast:** Techniques that draw attention to the main parts of the display are used (e.g., contrasting areas of light and dark, using dark papers for mounting light pictures).

TYPOGRAPHY

Typography deals with the appearance of printed text. **Type fonts** are complete character sets of stylized letters, numbers, punctuations, and symbols used in printing text. Letterform style and size are two appearance factors that affect legibility (how easily and comfortably written materials are read).

Nonstructural details at the ends of letter strokes, called serifs, are distinguishing font features. Fonts without these extra "side arms" or "curlicues" at the top or bottom of a letter are sans serif fonts. Serif fonts are the most easily seen and read from a printed page. They are frequently used in books, newspapers, and magazines. Times New Roman and Courier are widely used serif fonts. Web pages and electronic presentations often use sans serif fonts for easier screen reading and for their clean uncluttered look. Arial and Helvetica are examples.⁸

Type size should be matched to the targeted audience. General guidelines are as follows:

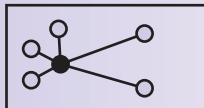
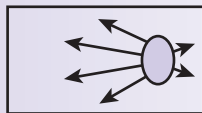
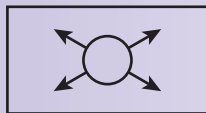
12 point for most adults up to age 65, larger 14 to 18 point for older audiences and those with visual handicaps, and 14 point for young children or beginning readers of any age.

Typographic emphasis, such as boldface and italicized text, should be used sparingly. Rather than drawing attention, their overuse lets nothing stand out. Bold face gives emphasis because it contrasts in color from the body of the text. Italicized text is less readable but gives emphasis

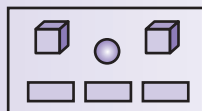


BOX 10-7 Basic Balance Designs

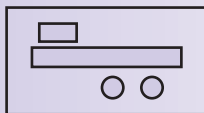
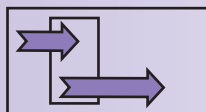
A. Radial Balance



B. Symmetrical Balance



C. Asymmetrical Balance



(A) Radial Balance: design units grow from a central point. (B) Symmetrical Balance: both sides of an imaginary line are the same. (C) Asymmetrical Balance: each side of an imaginary line is different, but equal.

Adapted from: Dearth, F. Construction and Utilization of Visual Aids in Dental Health Education. Thorofare, NJ: Charles B. Slack, 1974.⁷

by its contrasting shape. Underlining interferes with letter shapes and can slow reading. Two techniques that should generally be avoided are capitalizations and colored text. Within the text body, words and phrases in all uppercase letters are difficult to scan and grasp. Colored text can be used to give emphasis, but colors that are too close to the page background are hard for the eye to absorb. Yellow is typically a poor choice for lettering for this reason.⁶

READABILITY

Readability is a significant factor in literacy and a continual concern for educators. Health literacy data show that it is a concern for health professionals as well. Readability refers to the ease with which written materials are read and understood. It considers the difficulty of words used and the way sentences are written. The number of uncommon words and the length of sentences are also considered.

Tools for evaluating readability have been available since the 1920s. Some assess words for difficulty or for familiarity against frequency lists.

Most of them involve mathematical equations that can be applied to measurable elements in text. Counts of personal pronouns, number of syllables, and number of words in sentences are taken and used to make correlations with reading ease and understanding.^{6,9,10}

The number of readability formulas has steadily grown. Some widely used formulas include the following:

- **Flesch Reading Ease Score:** easy and widely used. Reports scores on a 0 to 100 difficulty scale. The higher the score, the easier the material is to read; 90 to 100 is appropriate for fifth grade level, 0 to 30 is college graduate level. Plain language targets a score of 65 on this scale. Patient education materials that score 60 to 70 on this test are good choices.¹⁰
- **SMOG (Simple Measure of Gobbledygook):** simple. Reports scores as number of years of education needed to read a document.¹⁰
- **Fry Readability Graph:** often used with health care materials. Reports scores as a point on a graph that correlates with reading grade level.^{6,10}



BOX 10-8 Media Design Considerations

Color	• Emphasizes important areas, creates moods, and focuses attention • Should be limited to two or three major colors
Captioning	• Gains attention for and stimulates interest in the display • Should be readable from all viewing points
Illustration(s)	• Convey the content and communicate the ideas of the display • Should use pictures, cartoons, photographs, drawing, or real objects
Layout	• Provides compositional form for the display • Directs the eye with a balanced design format
Typography	• Provides emphasis to allow important features to stand out • Font and type size should be appropriate to the medium being used
Readability	• Matches the reading level of the target audience • Should be easy to read and understand

- Flesch–Kincaid Grade Level Score: for reading grade levels. Reports scores as number of years of education needed to read text.¹⁰
- Dale–Chall: a vocabulary based formula. Matches text against word lists. Reports scores as reading grade level.¹⁰

Computer technology advances have led to the development of software that performs the mathematical calculations and has made the formulas easier to use. Commercial word processing and desktop publishing software programs often provide readability formulas as a language tool feature. Web sites allowing you to upload documents, cut and paste text for uploading, or input another web site's URL are available at no charge on the Internet. Sites offering these free online services, as well as sites giving detailed information for the mathematical calculations of various formulas are given in the Resources section at the end of this chapter. Box 10-8 highlights media design considerations.

Media Formats

Today's health educators are able to choose from a full range of media formats. Lesson plans can be supported and enhanced by something as simple as a poster or as complex as an elaborate electronic presentation. However, all media tools will not work equally well in all situations. Choices should be based on characteristics of the target audience, where the presentation will be given, and resources available to purchase or prepare media for the lesson. An overview of basic media formats and their use follows.

MASS MEDIA

Oral health educators can take advantage of many readily available communication tools that reach large numbers of people with a common message. Examples include magazines, newspapers, pamphlets, advertisements, radio, and television. Some applications for oral health education include

- communicating current, accurate scientific information to the public-at-large.

- publicizing special events and bringing special projects to the public's attention.
- presenting an oral health topic, and keeping it in the public's attention.

Many newspapers and magazines find their way into school classrooms and community health settings. These items can contribute to improved learning in a number of ways. They can provide

- new information that may not yet be available in textbooks.
- topics for panel discussions of controversial issues.
- opportunities for extra or specialized reading for those who want, and can manage, more detailed information.
- material for teaching displays.
- materials for career guidance.

Many of the world's people do not read or write, but are able to listen and observe effectively. Radio and television can impact health literacy; health educators must take advantage of both. The human voice conveys feelings and attitudes that can have a motivational impact on health behaviors. Health education promotions and even health advertising aired over these mediums can stimulate thinking about new ideas. Television and radio stations may volunteer airtime for health education and promotion programs, such as the American Dental Association's Dental Minute, during National Dental Health Month.

All that appears in print or is aired over radio and television may not be accurate or favorable. It is important to evaluate the quality and credibility of media statements about health practices or products. Assessing credibility begins with identifying the source, verifying the facts, and determining the motives behind a statement. Basic considerations include

- Who said it? Are they a recognized authority or reliable expert on the topic?
- Are the statements verifiable facts or merely an appeal to emotions?
- Is the behavior or product necessary to become and stay healthy?
- Is absolute success promised?

- What is the reason for making the statement? Profit-driven motives can be, but are not always, a cause for skepticism.¹¹

You will find a full discussion of how to assess credibility in Chapter 15.

NO-TECH MEDIA

There is no doubt about it and there is no turning back. We live in a world of sophisticated technology and much of it is integral to our everyday lives. Education has welcomed and adopted technological teaching tools as quickly as funds and facilities allow. Differences in audience needs, learning styles, and the importance of using multiple communication channels spotlight the need, however, to keep some classic instructional techniques in the educator's toolkit. There will always be a place for simple teaching tools to complement or deliver health education.

Chalkboards and Whiteboards. Chalkboards and whiteboards are inexpensive teaching tools, one of which is usually available in school classrooms and small meeting rooms. They are useful for spontaneously producing written instructions and graphic information. Marking on them takes no special skill; using them effectively does.^{7,11} Common sense suggestions for effective chalkboard and whiteboard use are

1. Write clearly:
 - Make chalk or marker lines bold enough to be seen in the back of the room.
 - Print everything for children in third grade or below.
 - Block letters, between 2 and 4 inch high, are easiest to read from a distance.
 - Choose colored chalks or marker colors that contrast enough to stand out against the background of the board. Use soft chalks that erase easily.
 - For removing marker inks and residue, try plain rubbing alcohol.
2. Stand to one side as you write. Do not turn your back toward the audience.
3. Repeat aloud what you write to help those with vision problems.
4. Talk to the audience; don't talk into the board.
 - A good pattern to use is: state the topic first when facing the audience, turn and write on the board; then, turn back to the audience and discuss the topic.
5. Make sure nothing obstructs anyone's full view of the board.
6. Organize information rather than scatter it all over the board.
 - Avoid writing near the bottom of the board.
7. Create a template for illustrations you draw frequently, such as a tooth or toothbrush.
 - Draw the figure onto heavy cardboard. Cut it out and use it against the board as a pattern for quick and accurate tracing. If available, lightweight plywood or masonite materials and power cutting tools can be used to make more permanent patterns.

Display Boards. Oral health educators often prepare displays to deliver a message. A fixed bulletin board with a dental message in a public area or classroom is one example. The portable backdrop of a table clinic is another. Both are used to support a topic with related graphics and illustrations. Display boards help to establish a conducive learning environment. They can be used to arouse interest, build concepts, and provide focal points for more intensive research and study.^{2,5,7,11}

Captioning is important. Working with stencils, precut letters, and pressure-sensitive letters can be time consuming. Words and phrases can be quickly produced with a word processing program and attached to the board. Letters made with the flat side of a crayon are interesting.⁷

Textures will attract attention. Try these techniques. Draw letters out with low-temp hot glue and quickly apply yarn, string, or twine to the glue. Dip yarn in heavy glue or starch, form into words or letters and attach to the board when dry. Use a "string guide" when you need straight guidelines for captioning or for placement of other items. Make your own by temporarily taping or pinning dental floss to the borders of the board where you want a straight guide!⁷

The illustrations that communicate the idea(s) of the display may be pictures, photographs, drawings, cartoons, or actual objects. Action pieces, such as self-check sheets or rotating turntables, can make a display interactive. Many materials can be used to create interest and sustain attention in what the board has to show and say.⁷

Examples with visual impact include the following:

- textiles: fabric patches, quilt batting, burlap, yarn, ribbons, raffia.
- dental items: toothbrushes, floss, radiographic images, tongue blades.
- reflective surfaces: small mirrors, aluminum foil.
- decorations: party supplies, wrapping paper, artificial flowers.
- miscellaneous: wallpaper, sandpaper, wire screening, pipe cleaners.⁷

Story Boards. Flannel and felt boards, hook and loop boards, and magnetic boards are inexpensive, easy-to-use teaching tools that can be used to help communicate abstract ideas and guide organized thinking about oral health through storytelling. They are particularly good for putting concepts, principles, generalizations, and facts into visual form.^{2,5,7,11} The classic “decay chain formula” is a good example of an oral health concept for the storyboard. Effective use depends on the storyteller knowing the story well enough to manipulate the characters and pieces freely and easily. Children enjoy placing the items on the board and retelling the story, so durability is important.

A hook and loop board is similar to the felt/flannel board, but offers some advantages. Various odd-shaped and heavier objects (up to several pounds) can be put on this board. It holds objects firmly, yet they can be instantly removed and reattached.

Many materials cling to a flannel surface with no special preparation. Colored felt is one example and can be easily cut into many shapes, designs, and symbols. Patterns for characters, shapes, or designs can be found in children’s coloring books. Two or more pieces of material may be glued together to increase stiffness

and durability. Smooth cardboard, small three-dimensional objects, and other flat surfaces can be backed with a rough textured material to give them holding capabilities. Coarse sandpaper or Velcro pieces are easy options. Glue magazine or other pictures that require some lightweight backing directly to the sandpaper or Velcro with a light application of rubber cement.

Magnetic boards, like the others, allow items to be temporarily displayed and manipulated easily while speaking. Magnetic chalkboards, with surfaces that have been prepared with a magnetic coating or paint, are available in many school classrooms. Portable magnetic boards can be easily made.

Samples, Specimens, and Real Objects.

Interactive experiences with authentic specimens, samples or other objects, from the real world make a learning experience personal and give meaning to subject content. These interactions can be tactile and auditory, as well as visual. Some real-world materials are readily available and inexpensive, whereas others are difficult or impossible to acquire. Disadvantages for the use of real objects include ensuring equal opportunities for interaction and storage when items are not being used.³

Radiographic film packets and radiographs, or digital printouts, dental mirrors or other nonsharp instruments, soft disposable saliva ejectors, individual units of polishing paste, and disposable cotton and paper products used in the clinical setting are examples of real objects that might find applications in an oral health presentation.

LOW-TECH MEDIA

Posters and Charts. Even in a high-tech world of computer-generated presentations, posters, and charts are effective and easy to use visuals. They have several advantages:

- They do not require electricity or specialized, elaborate equipment.
- They are easy to use and inexpensive to make and update.
- They are portable and transportable.
- They can remain in view of the audience while important points are being discussed.

- They provide good opportunities for interaction with the audience.

One major disadvantage is that posters and charts are not suitable for use with large groups. Because of their relatively small size, it is difficult for groups of more than 35 to see them well enough during a presentation.

Posters are pictorial designs that convey a message visually within a few seconds and quickly make a point. They can be effective with all age groups. Their purpose is to draw attention to an idea or topic, which makes them useful in creating or increasing levels of awareness. To be effective, a poster should focus on only one main idea.^{2,5,11}

Many oral health product companies offer free commercially prepared posters that may be suitable for selected topics. Student-made posters can be a useful activity for building learner interest and developing positive attitudes and values for oral health. When incorporated into a carefully designed lesson, they can be educational for those who make them and those who view them. Health professionals are cautioned, however, about using these projects as competition in “poster contests.” Producing an artful poster to win a prize does not necessarily translate into an ability, or commitment, to practice oral health behaviors.

Charts are used to highlight important points that have been made in a presentation. They are particularly useful for complementing the verbal commentary in a small group presentation. Charts can be used to outline information or to present a mixture of pictures, drawings, diagrams, or graphs.

Flip charts can be prepared in advance or developed spontaneously during a presentation. Materials required for using a typical flip chart include a large commercial flip chart pad, an easel or flip chart stand, and markers. Pages are turned or removed as sequential points are developed and discussed.^{2,5,11} Some suggestions to simplify preparation of a flip chart in advance are offered here.

- Before the presentation, pencil your text in lightly. This allows for adjustments to spacing

and any figures you will be drawing before using markers. Pads with grid lines make it easier to keep lines of text straight.

- Use print lettering that is large enough for easy legibility. One-inch letters can usually be seen from a distance of 32 feet; 2-inch letters from a distance of 64 feet. Do NOT use all capital letters. Upper case and lower case lettering is easier to read.
- Follow the “6×6 rule.” Use no more than six words on each line and no more than six lines on a sheet.
- Avoid writing with too many colors; one dark color and one accent color works best. Don’t write with pink, yellow, or orange markers!
- Write “speakers notes” lightly in pencil where needed. The audience won’t be able to see them and they can help you remember key points. You may also want to make a note at the bottom of the page to help you lead into or introduce the next sheet.

A simple tabletop mini-flip chart for use with individuals or very small groups can be made using a notebook and clear document protectors. Figure 10-1 shows a tabletop flip chart.

The strip chart is a different design for presenting information in sequence. It allows important points to be revealed gradually, one at a time. This chart is prepared before a presentation is given. Sequential information is listed and covered by strips of paper using light tack adhesive. Each strip is removed at the appropriate time when the point is being discussed. The sequenced parts remain in view, showing the building relationship of each part to the next. Strip charts are especially effective with primary grade learners.

Overhead Transparencies. Overhead transparencies, long a staple in educational settings, may be undergoing gradual replacement by more advanced technologies. Overhead projectors and transparencies are comparatively inexpensive, their use requires little skill, and they are relatively damage-proof. They can still be found in many classrooms and community facilities. Oral health educators should have a working knowledge of this media form.

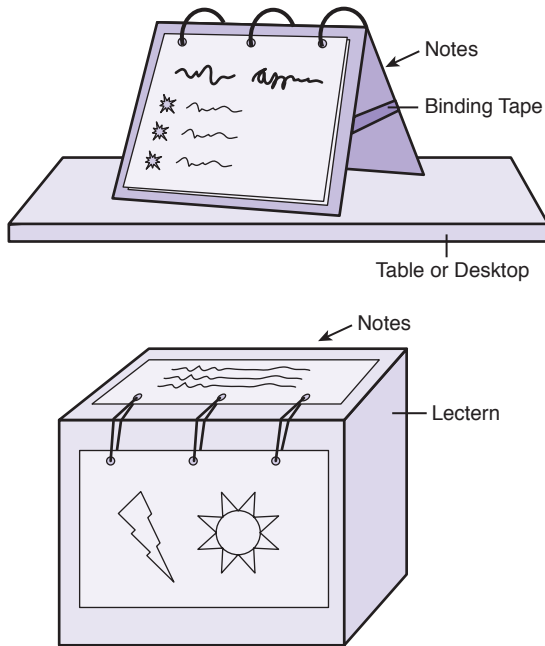


FIGURE 10-1 Table Top Mini-Flip Chart. A simple portable tabletop flip chart can be made from a three-ring notebook and clear document protectors. Visuals are positioned toward the side facing the audience, whereas speaking notes are directed toward the speaker.

Content transparencies are easy to prepare and update. Simple drawings or notes can be created spontaneously during a lesson by marking directly onto clear acetate sheets with a grease pencil or special water-based marker. More permanent transparencies can be made in advance by printing directly from a computer program onto a transparency sheet adapted for printers. Another method uses a regular copier machine to make a copy of a prepared drawing or picture onto a transparency sheet adapted for copiers.

Overhead transparencies are used in a lighted room, which reduces drowsiness and inattention. The projector is positioned in front of the group, which allows eye contact between the group leader and learners. Being able to observe reactions encourages interaction with the audience and lets a speaker make adjustments in a presen-

tation when needed. Some suggestions for effective use of overhead transparencies follow:

- Stand to one side of the projector, facing the audience to avoid casting a shadow of your body onto the screen.
- If writing by hand onto the transparency, make your letters at least half an inch high.
- Control the rate of presenting information by covering part of the transparency and exposing subsequent information when you are ready to discuss a point. Use an opaque piece of paper or cardboard as a cover. Place it onto the glass stage first with the transparency over it so you will still be able to see all of the transparency yourself.
- Face the audience, not the screen. Too often, speakers face, and end up talking to, the screen.
- Whenever information needs to be emphasized, point to the transparency with a pen to cast a pointing shadow on the screen.
- Don't crowd too much information onto one transparency. To illustrate complex ideas, such as decay progression, use overlays of additional transparencies to superimpose elements progressively onto a base transparency.
- Enlarge graphs, charts, or tables from books before reproducing them onto a transparency sheet.
- Leave material on the projector long enough for the audience to see and absorb.
- Store transparencies carefully to keep them clean and protected for future use.

HIGH-TECH MEDIA

Slides and Videos. Professionally prepared videos or slides can lend a professional appearance to an oral health presentation. Both are suitable for use with large groups. The American Dental Association, American Dental Hygienists' Association, oral health product companies, and companies that manufacture dental devices and materials are potential resources for slides and videos. Slides and videos can be expensive to

purchase and require special projection equipment. Projection equipment is relatively easy to operate and will typically be available in most schools and meeting facilities.

Slides can be arranged into any desired sequence and can be projected onto the screen for any length of time. Slides have some major disadvantages: they cannot be updated unless replaced, require a darkened environment for optimum viewing, and they cannot portray motion effectively.

Videos are particularly useful for presenting concepts that involve motion. They can be viewed by individuals or small groups, as determined by screen size. Due to production costs, videos can be expensive. Although not conducive to discussion and audience interaction, they can be very effective if the audience is prepared to receive them. Prior to showing a video, give the audience a task to do as they watch. Otherwise, they may decide to doze instead. Say something like “As you look at how the toothbrush is moved, see how it compares to your current brushing method.” Immediately after the video is finished, follow up by asking something like “So, how does your brushing method compare to the one you saw in the video?”^{2,5}

Computer-Generated Electronic Presentations. Electronic presentations are rapidly becoming the medium of choice in both business and education. Computer literacy has become a common job requirement. Many educational programs, dental included, require a minimum level of computer competency for admission.

Electronic media bring both challenges and advantages to educational situations. They give an up-to-date professional appearance to a presentation. They allow a speaker to bring a message to life with color, sound, pictures, and a variety of effects. This medium requires special digital projection equipment that can be expensive and may not be readily available in classrooms or other community facilities. Some familiarity with the equipment is needed to operate it confidently.

Electronic presentations are suitable for use with any size group and are easily inte-

grated into interactive audience discussions. Significant skill with authoring software is needed to create and produce an electronic presentation. Time to learn how to use this software is necessary if this is not already part of your skill set. Additionally, each electronic presentation requires considerable development time to compose content and create graphics. When completed, however, they are easy to change and update as needed.

Basic guidelines for creating electronic presentations include the following points:

- Use clear, standard fonts.
- Use a type size that is large enough project for reading from any part of the room. Recommendations for type size are 32 to 40 point for headings and 24 to 28 for main text. Use boldface for typographic emphasis and follow the general design principles for typography given earlier in this chapter.
- Limit the text to a few phrases per screen! Stick to the “6×6 rule” (six words across and six lines down).
- Write phrases, not sentences. With sentences, the tendency is to just read the words on the slides. Reading visuals aloud conveys the perception of lack of subject matter expertise and poor preparation.
- Use parallel grammar structure on each screen. Begin each point with the same part of speech, all verbs or all nouns, for smooth transitions between points. (This bulleted list is an example of parallel structure.)
- Follow the design principles for color use given earlier in this chapter.
- Keep the background simple. It is difficult to read text that is written over a thick or busy background. The background should show off the information, not overwhelm it.
- Curb the urge to go overboard with technology! Just because you can animate graphics and add sound, doesn’t mean you should. Visuals should make a point, not compete for Oscars in special effects!⁸

Table 10-2 gives an overview of common media and materials.

TABLE 10-2 EXAMPLES OF MATERIALS AND MEDIA FOR LEARNING EXPERIENCES

MATERIAL	ADVANTAGES	DISADVANTAGES
Audio: tape, disc, or CD	Useful in groups and with individuals Easy to make original recordings and duplicate tapes Commercial software is widely available Equipment is inexpensive, easy to use, and portable	Information is presented at a fixed rate and sequence Existing recordings are difficult to revise or update
Video: video recordings, videodiscs	Useful in groups and with individuals Deliver information through multiple senses Show actions and illustrate relationships Are reusable Typical equipment is widely available and easy to use	Information is presented at a fixed rate and sequence Existing recordings are difficult to revise, and updating can be expensive Equipment is moderately costly
Print Media: books and magazines, newspapers, brochures, pamphlets, fliers and fact sheets, posters, charts	Easy to use Useful in many locations Simple forms can be easily prepared Some are commercially available at no, or low, costs	Reading skills are needed Best with small groups Advanced forms may require costly preparation
Technology-Based: Overhead Transparencies	Useful with large group Simple preparation; Easily updated Used in a lighted room, facing audience Equipment is common	Overcrowded or cluttered transparencies can be distracting Can get out of order easily
Technology-Based: 35 mm Slides	Useful with individuals and large groups Compact and easy to use May be used singularly or in sequence; can be rearranged for various situations Equipment is common and simple to use	Requires a darkened room Do not convey motion Difficult to update
Technology-Based: Videos	Useful with individuals and medium groups Combines motion and sound with visuals Can be used to illustrate motion relationships and special effects Instant replays are possible	Fixed rate and sequence Expensive to update or revise
Technology-Based: Electronic Presentations	Useful with all group sizes Presentation pace can be controlled by presenter Can combine visuals with sound and motion Easily revised	Preparation is extensive and requires special skills Too many elaborate animations and/or sounds can be distracting Requires expensive equipment that is not always available at program sites

Adapted from: DeBiase CB. Dental Hygiene in Review. Baltimore: Lippincott Williams and Wilkins, 2001.²

COMMUNICATING ACROSS CULTURES

Expectations for health-related interactions, including oral health education, can be strongly influenced by culture. An awareness of, and respect for, cultural influences can help in the creation of culturally acceptable educational plans. Recognizing the many ways in which people are different, as well as the many ways in which they are the same, helps communications between oral health educators and audiences. Of paramount importance, however, is to understand and accept that we are all people with health needs and concerns.

The following guidelines are suggested for increasing communication and building trusting relationships across cultures.¹²

1. Behave formally in interactions with people who were born in another culture.
 - Using first names to show equality within exchanges is a uniquely American behavior. People from many cultures offer, and expect to receive, respect throughout the health care relationship. Address adults with deference to their age and status by using their title and last name (e.g., Mr./Señor X; Mrs./Señora X; Miss/Señorita X). This is especially important for Hispanic, Middle Eastern, former Soviet bloc, and some Asian cultures. Handshakes at the beginning of each meeting are important in Hispanic and Polish cultures.
2. Pay careful attention to nonverbal communication and communication styles. Body language, eye contact, and communication patterns are important communicators.
 - Make eye contact, without necessarily expecting it in return. Some cultures consider it disrespectful to look authority figures in the eye, while in others, avoiding eye contact is a way of showing respect for authority.
 - Conversational distance space for Westerners is about 5 feet. For people from the Middle East, an appropriate distance is about 2 feet from the person with whom they are speaking. This closeness may make Westerners feel uncomfortable or threatened as others move in toward them during a conversation.
3. Understand the role of the family in health care decision-making and care services. In many cultures, medical decisions are made by the immediate, or even extended, family.
 - In Hispanic cultures, *la familia* is a source of great emotional and physical support. Often gathering at sites where health care is provided, their presence contributes to the patient's and family's sense of well-being.
 - In Middle Eastern cultures, major responsibility for medical decision making falls to the family, with the father or oldest male acting as spokesperson.
4. Do NOT make any assumptions about a person's concepts of health or their beliefs about the causes of illnesses and ways to prevent or cure illness.
 - Follow a line of questioning that will help determine actual beliefs. Make questioning indirect by saying something like "Many of the people I know from [name of country] believe [or *visit* or *do* ...]. Do you ...?"

- Many cultures have a great trust in natural medicines, folk beliefs, and alternative medicine. Whenever possible, try to incorporate those that are not specifically contraindicated into recommendations.

Limited English Ability

When communicating with people who have limited English ability, speak slowly, not loudly. In some cultures, loudness conveys anger. It is not unusual to respond falsely to any angry questioner. Face the person to whom you are speaking and use gestures, pictures and facial expressions. Watch eyes and body language carefully. When these do not agree with the words used, it may indicate that what was said has been misunderstood.

Avoid difficult words or unusual idioms. These tend to confuse or intimidate many non-English speakers. Rephrase and summarize often. Try to say the same thing in at least two different ways. Don't ask "Yes" or "No" questions. The answer will only tell you that the question was heard, not that it was understood. Phrase questions with *what*, *when*, *where*, *why*, or *how*. These require a response that can only be made sensibly if the question has been understood.

Translators and Interpreters

There is a significant difference between translators and interpreters and in the work they do. Translators work with written materials, such as brochures, journals, or books. Translations are usually done from the second (nonnative) language into first (native) language. For example, a pamphlet written in Spanish that needs to be translated into English will typically be translated by a person whose native language is English and has learned Spanish as a second language. Some software companies offer sophisticated computer programs that are able to produce acceptable translations. Web resources should be searched and monitored to find any translated patient education materials that are available.

Interpreters assist in spoken communications between people with different languages. When using an interpreter, arrange the immediate

environment so that you, the interpreter and the person with whom you are speaking can all see each other. Look at the person with whom you are speaking, not at the interpreter. Use gestures and facial expressions. When you speak, and when the interpreter speaks, look at the face and eyes of the person with whom you are speaking. Watch for signs of comprehension, confusion, agreement, and disagreement.

Brief an interpreter before beginning. Summarize what will be said and emphasize the key information. Don't talk for more than 2 minutes without stopping to allow the interpreter to explain what has been said. Interpreters do not translate word-for-word. Instead, they attempt to convey the meaning of what has been said. Allow the interpreter time to think in another language that may have a completely different structure and communication pattern.

Summary

Oral health educators are frequently asked to plan and present oral health information to groups of varying sizes. These presentations may be given in conjunction with organized community health programs. They may be offered as a part of an individual dental professional's community service activities. In either instance, an understanding of instructional planning as a deliberate process is helpful. Basic guidelines for designing and developing a comprehensive educational plan have been presented in this chapter and some general parameters for creating and critiquing appropriate supporting materials have been described.

Learning Activities

1. Use one of the free online readability sites in this chapter's Resources section to calculate the readability of
 - a health profession's web site.
 - a paper that you have written as an assignment for one of your dental hygiene classes.

2. Write a short feature about an oral health topic of your choice that would be suitable for publication in a small locally operated newspaper. Calculate its readability statistics. Use a free site as before, or calculate manually using one of the formulas explained online at a site in the Resources section.
3. Look through a recent issue of the American Dental Association's Publications Catalog; select several pamphlets to review. Request one free copy of those you choose (the ADA will send one review copy of an item at no charge). Identify the target audience of each and assess its suitability for use in a health education lesson or community program using the features addressed in this chapter: readability (print size, plain language), design features (layout, use of color, white space, layout, etc.), and content organization and reliability.
4. Collect several samples of free patient materials from commercial companies that manufacture oral health products. Evaluate these for readability, design features and content reliability. Compare and contrast the free commercial materials with those from the ADA. Determine the suitability of these items for use in a health education lesson or community program.
5. Collect examples of newspaper or magazine articles about oral health. Share the articles you find with a group of your classmates. Discuss the accuracy, source, and motivation behind each.
6. Assume that you and a classmate have been asked to present a 30-minute oral health program for a group of 15 Girl Scouts ranging from 11 to 14 years in age. Brainstorm ideas for age-appropriate topics. For the chosen topic, write an educational goal and three specific instructional objectives.
7. Do a Web search for companies that make oral health products. Visit their web sites; examine and evaluate any educational programs they have developed and posted at the site. Determine whether the company offers free or inexpensive learning materials or activities.
8. Develop at least one learning activity and at least one idea for instructional media to support a Tobacco Cessation educational plan.
9. Perform a Web search for translation services in your area and in the nearest major cities. Find out what is available and how services can be obtained.

Resources

Making Health Communication Programs Work:

<http://www.cancer.gov/pinkbook>

Patient Education Workshop Online:

http://library.med.utah.edu/Patient_Ed/

Readability Formulas (how they are used and calculated):

http://www.centerforhealthstudies.org/capabilities/readability/ghchs_readability_toolkit.pdf

<http://plainlanguage.com/newreadability.html>

<http://www.tameri.com/teaching/levels.html>

<http://school.discoveryeducation.com/schrockguide/fry/fry.html>

Readability Calculators (Enter your own copy or any URL):

<http://juicystudio.com/services/readability.php#fleschkin>

<http://www.harrymclaughlin.com/SMOG.htm>

http://www.online-utility.org/english/readability_test_and_improve.jsp

<http://www.readabilityformulas.com/free-readability-formula-assessment.php>

Health Education Materials (lessons and activities): <http://www.bmcc.org/Headstart/Dental/>

Breaking Down Language Barriers:

http://dental.pacific.edu/Professional_Services_and_Resources/Dental_Practice_Documents.html

<http://www.dentalcare.com/soap/patient/index.htm>

Cultural Competency:

Online Tutorial Core Curriculum and Ethnic Specific Modules from Curriculum in Ethnogeriatrics:

<http://www.stanford.edu/group/ethnoger/>

<http://culturedmed.sunyit.edu/>

<http://www.thinkculturalhealth.org/>

<http://www.amsa.org/programs/gpit/cultural.cfm>

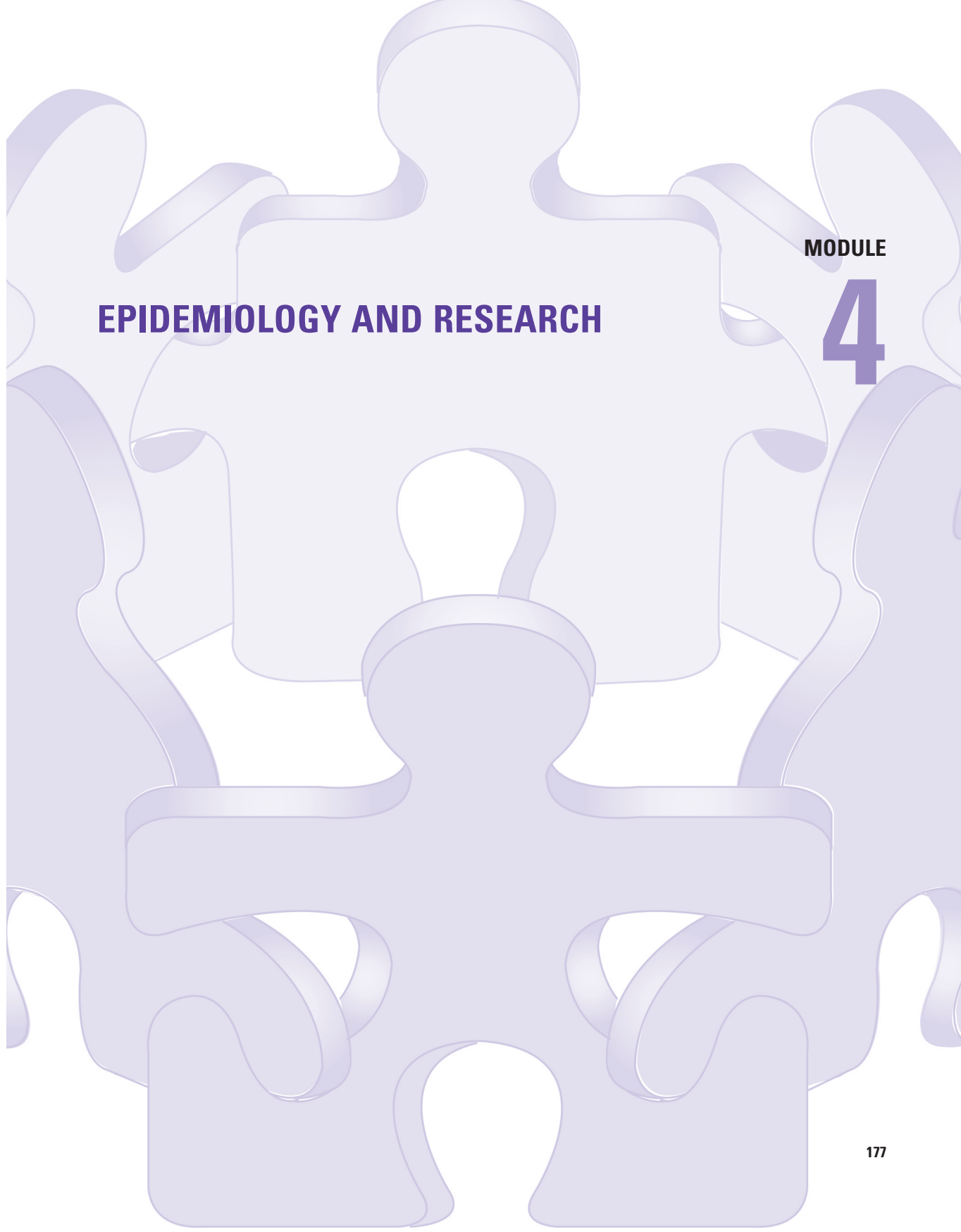
Review Questions

- State and explain two advantages of a well organized lesson plan.
- To introduce age-appropriate oral health concepts to second grade teachers attending the Teacher Training Workshop at the beginning of the school year. This statement best exemplifies which of the following?
 - Lesson plan
 - Educational goal
 - Instructional objective
 - Condition criteria
- Of the following which is the better example of an instructional objective? Upon completion of the learning experience the learner should be able to:
 - ... appreciate the value of good oral hygiene.
 - ... know four brushing methods.
 - ... demonstrate the Bass brushing technique.
 - ... understand why brushing and flossing are important.
- Presentation structure for the content of a lesson plan includes
 - set, body, closure
 - staging, action, ending
 - objectives, goal, closure
 - content, body, summary
- Make an argument for student-made posters but against a poster contest.
- A middle-school teacher has never used newspapers or magazines in the classroom. Explain at least three ways these materials can be used to support learning experiences to this teacher.
- How might a person from a Middle Eastern culture convey the importance they attach to what they are saying?
 - by repeating it several times
 - by saying it loudly
 - by pointing their fingers at the person to whom they are speaking
 - by speaking in a high-pitched voice
 - a and d
- Identify the central focus for all instructional planning events.
 - the teaching strategy that will be used
 - the instructional materials that are available
 - the content that must be presented
 - the target audience of intended learners
- What is the purpose for covering parts of the information on a strip chart?
- The typical conversational distance between people in Western cultures is about ____ feet; the typical distance for Middle Eastern cultures is _____.
 - 5; 5
 - 5; 2
 - 3; 1
 - 6; 3

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MODULE

4

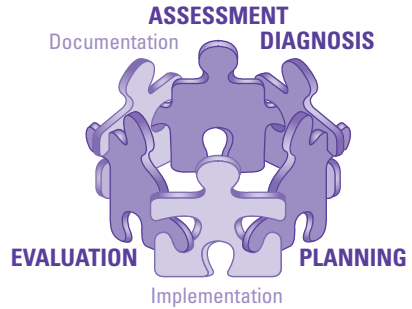
EPIDEMIOLOGY AND RESEARCH

Concepts in Epidemiology

Objectives

After studying this chapter and completing the study questions and activities, the learner will be able to:

- Define epidemiology and oral epidemiology.
- Describe an epidemiologic triangle for dental caries.
- State the difference between morbidity and mortality.
- Explain the difference between incidence and prevalence.
- Describe the types of study designs commonly used in epidemiology.
- Explain the importance of sensitivity and specificity for a screening test.



KEY TERMS

Agent

Analytic studies

Associated

Case control

Causative factors

Cohort

Confounding variables

Count

Cross-sectional study

Descriptive study

Endemic

Environmental factors

Epidemic

Epidemiology

Experimental study

Host factors

Incidence

Index

Morbidity

Mortality

Multiple causation

Observational study

Oral epidemiology

Pandemic

Predictive value

Prevalence

Proportion

Prospective

Retrospective

Sensitivity

Specificity

See Appendix 3 for the ADEA competencies addressed in this chapter.¹

Introduction

By turning to basic medical terminology, we can learn the literal definition of the term **epidemiology**. The prefix, epi-, means “on, upon, befall.” The root, demo, means “people, population, man,” and the suffix, -ology, means “the study of.” If taken literally, epidemiology is “the study of that which befalls man.”

Epidemiology, often considered the core science of public health, can be more accurately defined as the study of the distribution and determinants of health-related states or events in specified populations.² In other words, epidemiol-

ogists study how often disease occurs in different population groups and why. In epidemiology, the primary units of concern are groups of persons, not separate individuals. For this reason, thinking in epidemiologic terms often seems foreign to clinicians trained to think of the unique problems of each individual patient. By studying groups of individuals, epidemiologic information can be used to plan and evaluate strategies to prevent illness and as a guide in the management of patients in whom disease has already developed.

Public health has found the principles of epidemiology useful in assisting with its mission of protecting the health of populations and groups.

General uses of epidemiology include, but are not limited to

- the study of the history of disease.
- assessing and evaluating public health and clinical health services.
- determining the cause and source of disease.
- determining what diseases, conditions, injuries, or disorders cause illness, health problems, or mortality in a community.

- complementing and completing the clinical picture of disease.

AN HISTORIC EVENT: JOHN SNOW'S NATURAL EXPERIMENT

One of the most famous events in the history of epidemiology was a natural experiment reported more than 150 years ago by John Snow, a British

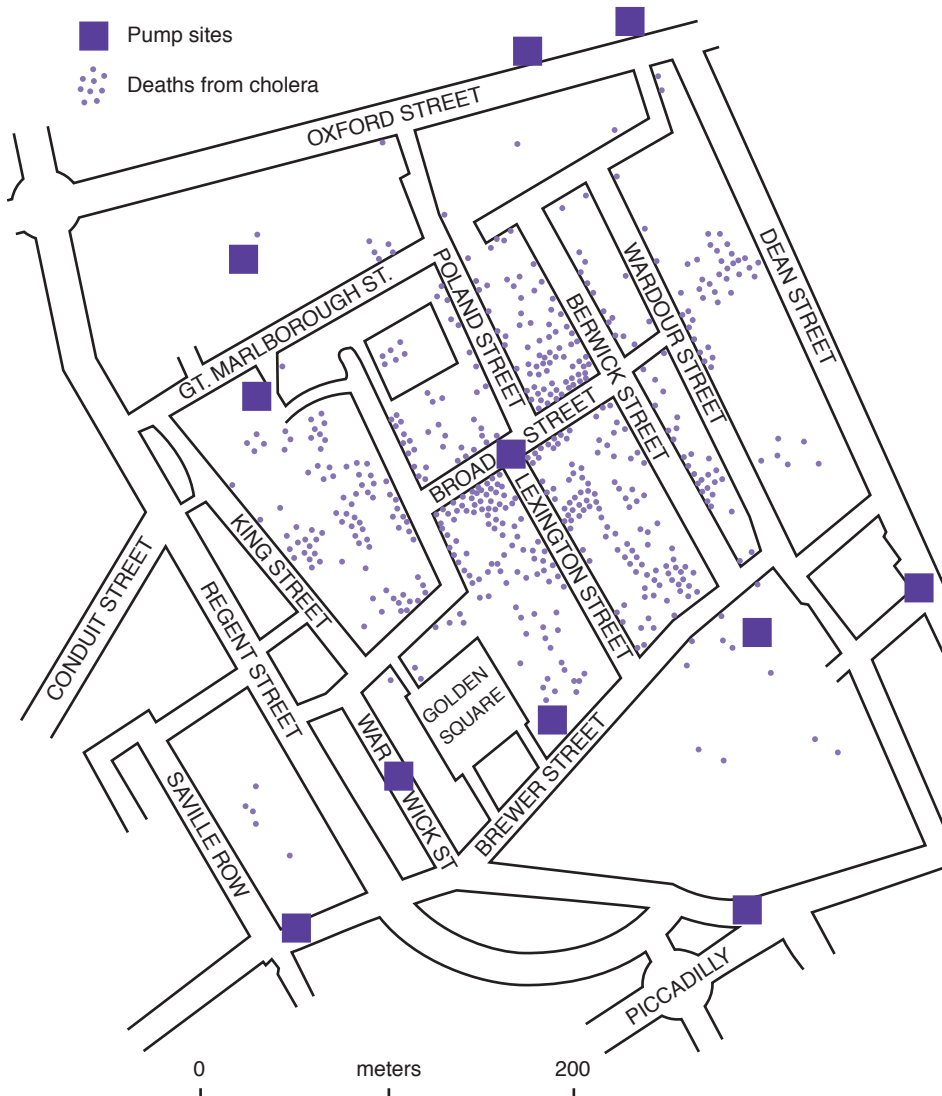


FIGURE 11-1 John Snow's map of the Soho area of London, showing deaths from cholera during the epidemic of 1854.³

TABLE 11-1 ATTACK RATE OF FATAL CHOLERA AMONG CUSTOMERS OF SOUTHWARK AND VAUXHALL (EXPOSED COHORT) AND LAMBETH (UNEXPOSED COHORT), LONDON, 1854³

	WATER COMPANY	
	SOUTHWARK AND VAUXHALL	LAMBETH
Cholera deaths:	4,093	461
Population served by water company:	266,516	173,748
Attack rate:	0.0154	0.0027

physician. In 1854, a cholera outbreak in London claimed thousands of lives. During this time, several water companies piped drinking water to community pumps throughout London (this was before indoor plumbing), and Snow found that many of the deaths were occurring around one particular water pump—the Broad Street pump in Soho. The company that provided water to this particular pump, the Southwark and Vauxhall Company, piped water from the Thames river within London’s city limits, and Snow hypothesized that the cholera outbreak was due to water contaminated by sewage (although this was before the formulation of the germ theory). Snow compared the cholera mortality (death) rates for residents subscribing to the Southwark and Vauxhall Company and for residents subscribing to the Lambeth Company that obtained its water upstream of London (therefore, not contaminated by London’s sewage). During 1854, there were 4,093 cholera deaths among the 266,516 customers of the Southwark and Vauxhall Company and 461 cholera deaths among the 173,748 customers of the Lambeth Company (Table 11-1 and Fig. 11-1).³

In September 1854, Snow convinced local authorities to remove the handle from the Southwark and Vauxhall water pump at Broad Street and the epidemic soon subsided.

EPIDEMIOLOGY AND ORAL HEALTH

Although you may be aware of the role of epidemiology in the practice of medicine and public health, the science of epidemiology is also basic to

the practice of dentistry, dental hygiene, and dental public health. When epidemiology is applied to oral health issues, it is often referred to as **oral epidemiology**. One classic example of the use of epidemiology in oral health was the discovery of the relationship between mottled teeth, dental caries, and fluoride. In 1916, Black and McKay⁴ presented the first of a series of reports on what was then called “mottled enamel” in children in certain areas of Colorado. The search for the cause of mottled enamel culminated in a report by Smith et al.⁵ in 1932 that implicated a relatively high amount of fluoride in the soil and water. Up to this time and for several years thereafter, mottled enamel was considered a pathologic condition, with fluoride as the undesirable causative **agent**. During the 1930s, however, several investigators began to notice a possible relationship between the high fluoride content of soil and water, mottled enamel, and an apparent resistance to dental caries. By the mid- to late 1930s, it became apparent that fluoride in drinking water was inversely related to dental caries experience; as fluoride level increased, caries rates decreased.

A more modern example of the use of epidemiological research in oral health relates to the association between smoking and periodontitis. Based on epidemiologic investigations, there is compelling evidence that cigarette smokers are more likely than nonsmokers to experience the onset and progression of periodontal destruction and that smokers have a poorer prognosis following periodontal therapy.⁶⁻⁹ To estimate the proportion of adult periodontitis in the United States that could be attributed to cigarette smoking, Tomar and Asma¹⁰ used data from the Third

National Health and Nutrition Examination Survey (NHANES III)—a multipurpose health survey conducted from 1988 to 1994 by the National Center for Health Statistics of the Centers for Disease Control and Prevention.

The investigators found that current smokers were about four times as likely to have periodontitis as persons who had never smoked, former smokers were about two times as likely to have periodontitis as persons who had never smoked, and that among current smokers there was a dose-response relationship between cigarettes smoked per day and the odds of periodontitis. Using standard epidemiologic formulas, the investigators calculated that 42% of periodontitis cases in the U.S. adult population were attributable to current cigarette smoking and 11% to former smoking. Based on epidemiologic studies such as this, we now know that a large proportion of adult periodontitis may be preventable through prevention and cessation of cigarette smoking.

THE SCOPE OF EPIDEMIOLOGY

As previously stated, epidemiology is the study of the distribution and determinants of diseases. In the early history of epidemiology, the primary diseases of concern were generally infectious in nature (e.g., cholera, typhoid). Today, the science of epidemiology is applied to all diseases, conditions, and health-related events, including chronic disease, health services research, program planning, and program evaluation. It is concerned not only with epidemics but also with interepidemic periods and sporadic and endemic occurrences of disease.

Endemic is defined as the constant presence of a disease or infectious agent within a given geographic area; it may also refer to the usual prevalence of a given disease within an area. An **epidemic** is an unusually high occurrence of disease or the occurrence in a community or region of cases of an illness clearly in excess of normal expectancy.² The definition of unusually high or in excess of expectancy may differ depending on the circumstances, so there is no clear demarcation between an epidemic and a small

fluctuation. Even a single case of smallpox would exceed expectancy anywhere in the world today, whereas, until recently, 100 cases in a single year might have been within the expected number in Ethiopia or India.

A disease that remains epidemic over many years may eventually be considered endemic and many chronic diseases or problems are endemic in nature. That is, they are widespread and do not exhibit great variability in frequency from year to year. For example, hypertension, one of the risk factors for cardiovascular and cerebrovascular disease, is one of the more prevalent conditions in the United States. Approximately 27% of all Americans 20 to 74 years of age have hypertension and 82% of women ages 75 years and older have hypertension.¹¹ In 2005, more than 24,900 deaths were attributed to hypertension, for a death rate of 8.4 per 100,000 population.¹² This illustrates the fact that both endemic and epidemic conditions are important to public health and the science of epidemiology.

Another term used to describe the occurrence and distribution of disease is **pandemic**. A pandemic is a disease or infection occurring worldwide or over a very wide area. Acquired immune deficiency syndrome (AIDS) is an example of a pandemic.

With an infectious or communicable disease, a single factor, or agent, must be present for the disease to occur. The presence or absence of the agent alone, however, does not determine if an individual will get a disease. Other factors, including the immunity of the host, play a role in the onset of disease. The concept that more than one factor must be present for disease to develop is referred to as **multiple causation**. A single bacterium living in isolation is not sufficient to cause an outbreak of a disease and cannot by itself be responsible for the outbreak or labeled as the cause. The mode of transmission, ability of the organism to grow and propagate, communicability of the organism, level of immunity within the population, and the density of the population or the proximity of the cases to one another are other factors that contribute to the level or intensity of an outbreak. Therefore, an agent may be a necessary but not a sufficient cause of disease.

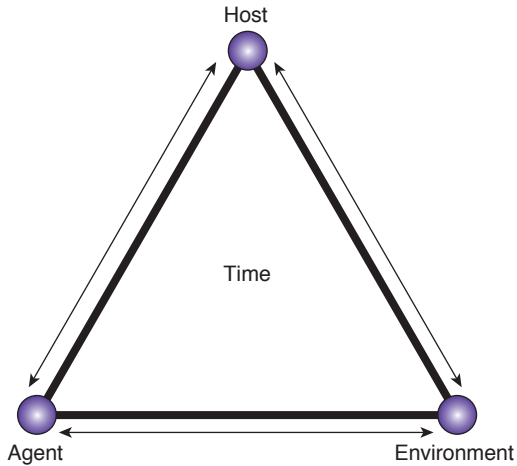


FIGURE 11-2 The epidemiologic triangle.

In epidemiology, it is customary to consider three primary factors when assessing the development of disease: (i) the agent, (ii) host factors, and (iii) factors in the environment. The agent is the cause of the disease (for infectious diseases), **host factors** affect an individual's susceptibility to a disease, and **environmental factors** influence exposure and may indirectly affect susceptibility as well. These three factors comprise what is often referred to as the epidemiologic triangle (Fig. 11-2). A fourth factor—time—is also a component of any disease process.

The epidemiologic triangle is basic and fundamental to all epidemiologic principles; however,

it was based on communicable diseases, which are no longer the leading cause of illness or death in most industrialized nations. For this reason, the model is often modified when referring to chronic diseases such as dental caries and heart disease. For instance, the term agent is often replaced by a reference to **causative factors**; and host factors include important behavioral and lifestyle factors, such as smoking. Figure 11-3 depicts an epidemiologic triangle or epidemiologic model for dental caries.

MEASURES OF DISEASE OCCURRENCE

To study the distribution and determinants of disease, disease must be accurately measured. Measures of disease range from simple counts to more complex measures, such as rates and indices.

Counts

The simplest measurement of disease is a **count** of the number of persons in a group who have a particular disease or characteristic. It may be noted that 50 children in an elementary school have dental caries or that 12 dental patients with advanced periodontitis smoke cigarettes.

Proportions and Rates

For a count to be descriptive of a group, it must be seen as a **proportion** (i.e., it must be divided

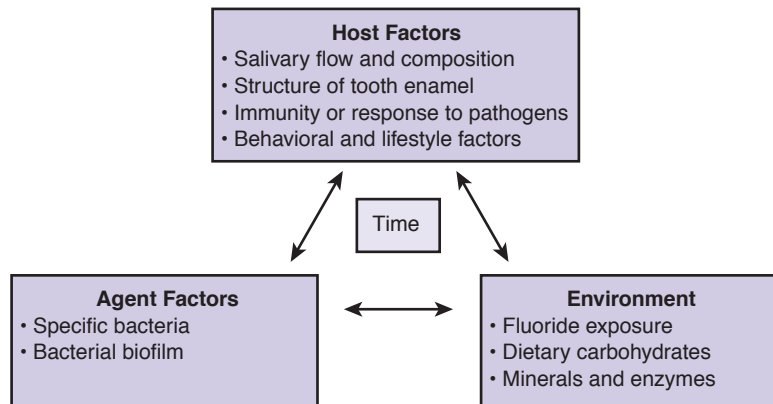


FIGURE 11-3 Epidemiologic triangle for dental caries.



BOX 11-1 Formula for Rate

Rate =

$$\frac{\text{Number of events, cases, or deaths}}{\text{Population in same area in a time period}}$$

by the total number in the group). The 50 dental caries cases mentioned earlier would have a different significance if the elementary school had an enrollment of 600 or if the school only had an enrollment of 100. In the first case, the proportion would be 50/600, 0.08, or 8%. Percentage, or number per 100, is one of the most common ways of expressing proportions. In the second case, the proportion would be 50/100, 0.50, or 50%.

Certain kinds of proportions are frequently used in epidemiology. These are referred to as rates. The various types of rates involve or imply some time relationship. The numerator of a rate is the number of people with the disease being counted; the denominator is the population at risk of the disease or event (Box 11-1). Rates of disease are called **morbidity** rates, and rates of death are called **mortality** rates. Two commonly used rates that every dental professional should understand and remember are incidence and prevalence.

INCIDENCE

Incidence describes the rate of development of a disease in a group over time, which is included in the denominator; or, the rate at which new



BOX 11-2 Formula for Incidence Rate

Incidence Rate =

$$\frac{\text{Number of persons developing a disease}}{\text{Total number at risk per unit of time}}$$



BOX 11-3 Another Formula for Incidence Rate

Incidence Rate =

$$\frac{\text{Number of persons developing a disease}}{\text{Total time experienced for the subjects followed}}$$

disease cases occur in a population during a specified period (Box 11-2). Think of incidence as a video—it captures a series of events (cases of disease) during a period (usually a year). As an example, the age-adjusted incidence of cancer of the oral cavity and pharynx in the United States during 2005 was 14.4 new cases per 100,000 population in men and 6.0 new cases per 100,000 population in women.¹³

Occasionally, measurement of incidence is complicated by changes in the population at risk during the period when cases are ascertained, such as through birth or death. This problem is overcome by relating the numbers of new cases to the person years at risk, calculated by adding together the periods during which each individual member of the population is at risk during the measurement period. Therefore, incidence can also be defined as the number of persons developing a disease divided by the total time experienced for the subjects followed (Box 11-3).

PREVALENCE

Prevalence describes a group at a certain time. It is like a snapshot, rather than a video, of an existing condition or a measure of disease status. The simplest way of considering disease status is to consider disease either present or absent. Prevalence is the proportion of people in a population that have disease. For example, the prevalence of gingivitis in a middle school during a dental screening on November 10 was 54%; or, the prevalence of untreated decay in third-grade children during Dental Health Month was 25%.

Several factors affect disease prevalence, including disease occurrence (incidence) and duration of disease. The greater the incidence



BOX 11-4 Formula for Prevalence Rate

$$\text{Prevalence Rate} = \frac{\text{Number of persons with a disease}}{\text{Total number in group}}$$

of disease, the greater the number of people who will have it. The longer the duration of disease once it occurs, the higher the prevalence. Diseases with short duration may have a low prevalence even if the incidence rate is high. The prevalence of upper respiratory infection may be low despite a high incidence because, after a brief period, most people recover. Duration may also be short for a grave disease that leads to rapid death. Therefore, the prevalence of aortic hemorrhage would be low even if it had a high incidence because it generally leads to death within minutes. In contrast, a disease with low incidence could have a high prevalence if the duration of the disease is long or the effects not reversible. For example, the prevalence of gingival recession (>1 mm) in adults between 50 and 64 years of age was 56% in 1999 to 2004.¹⁴

Because prevalence reflects both incidence rate and disease duration, it is not as useful as incidence

for studying the causes of disease. It is extremely useful, however, for measuring the disease burden in a population.¹⁵ Refer to Box 11-4 for the formula for prevalence rate and to Box 11-5 for the difference between incidence and prevalence.

Indices

Dentistry uses another measure of disease referred to as an **index** (plural, indices or indexes). An index is a graduated, numeric scale with upper and lower limits. Indices allow for the measurement of disease severity, rather than just disease incidence or prevalence. For example, a teenager with dental caries on 4 of 28 teeth has a lower level of disease than a teenager with caries on 12 of 28 teeth; however, both would be considered to have disease in the calculation of caries prevalence. By using an index, we can quantify how much disease a person has. Common indices used in dentistry include the DMFT/DMFS index and the Plaque Index. Chapter 12 contains a detailed description of dental indices.

GENERAL TYPES OF EPIDEMIOLOGIC STUDIES

Descriptive, Analytic, Experimental, and Observational

Learning about causes of disease through epidemiologic studies is generally a gradual process that requires different types of study design, depending on the nature of the disease, possible etiologic agents, and the current state of knowledge about the disease. One overall way to classify epidemiologic studies is into two broad categories: (i) descriptive studies, which are usually undertaken when little is known of the epidemiology of a disease; and (ii) **analytic studies**, which are carried out when leads about etiology are already available (Box 11-6). Descriptive studies study the amount and distribution of disease; analytic studies evaluate the determinants of or risk factors for disease. Descriptive studies tell you who is affected, where cases occur, and when cases occur; analytic studies tell you why disease rates are high in a particular group.



BOX 11-5 The Difference Between Incidence and Prevalence

To remember the difference between incidence and prevalence, think of incidence as a video and prevalence as a snapshot. Incidence measures the number of new disease cases during a period (like a video); prevalence measures the number of cases of disease at a given point (like a snapshot).



BOX 11-6 The Difference Between Descriptive and Analytic Studies

DESCRIPTIVE STUDY

Looks at amount and distribution of disease: Who gets the disease and where and when does disease occur?

Used to *develop* hypotheses

ANALYTIC STUDY

Looks at determinants of disease: Why do people get the disease?

Used to *test* hypotheses

Descriptive studies are usually the first step in looking at a disease and often use existing data sources. A **descriptive study** usually looks at the prevalence of disease by person (e.g., age, gender, race, ethnicity, socioeconomic status, occupation), place, and time to describe groups at higher risk of developing a disease. The most common descriptive study is a cross-sectional or prevalence study. In a **cross-sectional study**, disease status and exposure to risk factors are measured at one point in time. An oral health status survey is an example of a cross-sectional study.

Information gathered during a descriptive study is used to build a model and develop a hypothesis for further research. An analytic study design is then used to test the causal hypotheses generated through descriptive studies. Traditionally, analytic studies have been classified as either experimental or observational, although these terms are used less frequently today. In an **experimental study**, an investigator studies the impact of a factor that he or she controls. If an investigator is interested in the health effects of secondhand cigarette smoke on a litter of rats, the investigator can expose one-half of the litter to secondhand smoke and not expose the other half. Experimental studies on humans, however, are often not possible because of ethical considerations, with the exception of intervention trials or clinical trials testing a treatment for a disease. An example of an experimental study in dental public health is the clinical trial testing fluoride varnish for the prevention of dental caries in which one-half of study participants receive the active agent and the other half receive a placebo.¹⁶

Because experimental trials are not always possible or appropriate, investigators may select a study design in which they “observe” the impact or health effect of a factor in a population that is already segregated into groups on the basis of some experience, exposure, or disease (married versus single, smoker versus nonsmoker, periodontitis versus no periodontitis). This study design is called an **observational study**. To determine if smoking is associated with advanced periodontitis, an investigator could look at pocket depth and loss of attachment in smokers compared with nonsmokers. To determine if alveolar bone loss is associated with skeletal bone loss (osteoporosis), an investigator could follow adults for several years to determine if individuals with skeletal bone loss also have alveolar bone loss.

The primary difficulty with observational studies is that observed groups may differ, not only in the factor under study but also in other factors. In the previous example on advanced periodontitis and smoking, nonsmokers may differ from smokers in ways other than their smoking habit. They may differ in terms of oral hygiene, education, and access to preventive dental care; factors that may influence periodontal health regardless of smoking status. These other factors—known as **confounding variables**—may make it more difficult to demonstrate the role of the specific factor under study (smoking).

A common sequence in the discovery of a causal association between an agent and a disease—using each of the previously described study designs—is as follows. First, clinical observations suggest a possible causal association between a factor and a disease. Second, descriptive

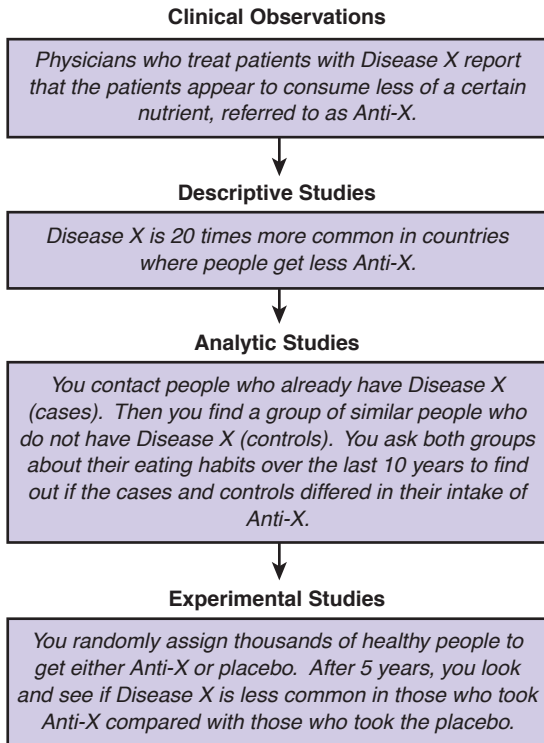


FIGURE 11-4 Potential sequence in the discovery of a causal association

epidemiologic studies establish the association on a population level. Third, analytic epidemiologic studies establish the association on an individual level. Fourth, experimental studies reproduce the disease when the risk factor is introduced and/or elucidate potential pathogenic mechanisms between the disease and the risk factor. Finally, observational studies find that removal of the risk factor alters the incidence of disease (Fig. 11-4).

Let us return to the previous example of mottled teeth, dental caries, and fluoride. Early in the 20th century, observations of mottled enamel and tooth decay prevalence in communities throughout the United States led to the discovery in analytic epidemiologic studies, and then in animal studies, that fluoride in drinking water was responsible for mottled enamel and also for protection against dental caries. Belief

in the causal nature of the association was further strengthened by studies showing that the frequency of mottled enamel decreased and the frequency of dental caries increased when communities changed from drinking water sources high in fluoride to sources low in fluoride. Finally, experimental studies in which fluoride was added to the water of some communities but not others clearly established both the causal nature of the relationship and the efficacy of fluoridated drinking water in reducing the frequency of dental caries.

Retrospective, Prospective, Cohort, and Case-Control

As previously mentioned, the terms experimental study and observational study are being used less frequently to describe a general type of epidemiologic study design, mainly because experimental studies and observational studies often use similar epidemiologic techniques to study the relationship between disease and a potential risk factor. The more common terms now used to describe different types of epidemiologic studies are retrospective, prospective, cohort, and case-control. **Retrospective** and **prospective** refer to the timing of the information and events of a study; cohort and case-control refer to the type of population being studied.

Let us start with a description of **cohort** study and **case-control** study. In epidemiology, a cohort is defined as any designated group of individuals who are followed or traced over time.² In a cohort study, new cases of disease are measured in a group of people who are or have been exposed to a factor believed to influence the occurrence of the disease. The cohort is followed over time, usually with the aim of comparing disease rates for two or more cohorts. Because most cohort studies look toward the future, they are occasionally referred to simply as prospective studies, although some cohort studies can be retrospective in nature. If you see a reference to a prospective study design, you can usually assume that the study is actually a prospective cohort study. Prospective studies are also referred to as longitudinal studies.

The following is an example of a prospective cohort study designed to assess potential risk factors for osteoporosis in women ages 65 years and older.¹⁷ During the 1980s, four clinical sites recruited a cohort of almost 10,000 older women. Detailed information on potential risk factors for osteoporosis was obtained from each woman through a questionnaire, physical examination, bone mineral density test, and an interview. The women were then followed over time, with a contact every 4 months to determine if they had fractured a bone. If a woman reported a fracture, medical records were obtained to verify that a fracture actually occurred. In simplistic terms, women within the cohort were classified according to a specific risk factor. Fracture incidence in women with and without the risk factor was then compared.

Although most cohort studies are prospective in nature (e.g., they follow a cohort forward in time), a cohort study may also be retrospective. In a retrospective cohort study, occasionally referred to as an historic cohort study, the cohorts are identified from recorded information, with the time during which they were at risk for disease occurring before the beginning of the study.

Although a cohort study provides a vast amount of information on risk factors for disease, following a large cohort over time can be expensive. The case-control study design aims at achieving the same goals as a cohort study, but more efficiently. In a case-control study, persons with a given disease (the cases) and persons without the given disease (the controls) are selected; the proportion of cases and controls who have a certain background characteristic or who have been exposed to possible risk factors are then

determined and compared. Because a case-control study often looks to the past for exposure, it is often referred to as a retrospective study.

Case-control studies are one of the most frequently undertaken types of epidemiologic study. They can generally be carried out in a much shorter period than cohort studies, do not require nearly so large a sample size, and, consequently, are less expensive.

The following is an example of a case-control study designed to evaluate the association between fluoride exposure and hip fractures.¹⁸ The county of Cleveland in northeast England has one area with water naturally high in fluoride (1.0 ppm); the rest of the county has water with a low fluoride concentration. In this case-control study, the cases were adults who were admitted to the county's three hospitals with newly diagnosed fractures of the femoral neck (hip fractures). The controls were adults randomly selected from those registered with the National Health Service, matched to the cases by age and sex.

Both the cases and controls were interviewed to obtain information on demographic variables, height, weight, lifetime residential history, usual physical activities, age at menopause, alcohol consumption, smoking history, recent medication use, and dietary sources of calcium and fluoride. As presented in Table 11-2, the investigators found no evidence of any increase in the risk of hip fracture from fluoride in drinking water at concentrations of about 1 ppm.

THE CONCEPTS OF CAUSALITY AND RISK

At the beginning of this chapter, “determining the causes and sources of disease” was listed as one of the general uses of epidemiology.

TABLE 11-2 ASSOCIATION OF HIP FRACTURE WITH EXPOSURE TO FLUORIDE IN DRINKING WATER¹⁸

LIFETIME EXPOSURE TO WATER CONTAINING:	CASES	CONTROLS	ODDS RATIO (ADJUSTED)
< 0.9 ppm fluoride	380	346	1.0*
≥ 0.9 ppm fluoride	80	77	1.0 (0.7–1.5)

* Reference category.

Unfortunately, determining the “cause” of a particular disease is not an easy task, especially given the multiple causation or multifactorial etiology of chronic diseases. What epidemiologic studies provide us with is information on which host and environmental factors are **associated** with an either increased or decreased risk of developing disease in a population, together with the strength of the association. In fact, many statistical measures obtained from epidemiologic studies are referred to as measures of association or measures of risk.

The concept of risk for disease is widely used in public health and is measured on the same scale and interpreted in the same way as a probability. In other words, risk is the probability that a specified event will occur. A risk factor is an attribute or exposure that increases the probability or risk of disease occurrence (also referred to as a determinant). For example, smoking is a risk factor for periodontitis and xerostomia is a risk factor for root caries. Refer to Chapter 14 for more information on the criteria for determining causality.

SCREENING FOR DISEASE AND DISEASE RISK

Over the years, various diagnostic and screening tests have been developed to determine if an individual has oral disease or is at increased risk of developing either dental caries or periodontal disease. Unfortunately, clinical diagnosis is not necessarily a perfect process and two different diagnostic approaches to the same disease may not lead to the same classification for every patient. To obtain something more than an impression of the quality of a diagnostic or screening test, it is useful to calculate quantitative indices of the accuracy of a test. For a diagnosis that is dichotomous (disease or no disease), there are two separate aspects of the accuracy of diagnosis. One is **sensitivity**, defined as the proportion of those who truly have the disease that are correctly classified as having it. The other is **specificity**, defined as the proportion of those who truly do not have the disease that are



BOX 11-7 Formula for Sensitivity and Specificity

TEST RESULTS	ACTUAL DISEASE STATE	
	DISEASE	NO DISEASE
Positive	A	B
Negative	C	D
	A+C	B+D
Sensitivity = A/(A+C)		
Specificity = D/(B+D)		

correctly classified as not having it (Box 11-7). The goal of any diagnostic or screening test is to have a sensitivity and specificity as close to 100% as possible. In addition, an ideal test should also be simple, inexpensive, acceptable to the patient, and reliable. The easiest way to conceptualize sensitivity and specificity is through an example from medicine. The Papanicolaou (Pap) test is the mainstay of cervical cancer screening. The Pap test, however, is not perfect—it results in both false positives and false negatives. Box 11-8 includes data from a study evaluating cervical cancer screening tests.¹⁹ Of the 8,554 women in the study, 31 had a false negative (they had cervical cancer, but the Pap test was negative) and 488 had a false positive (they did not have



BOX 11-8 Sensitivity and Specificity for Pap Tests¹⁹

PAP TEST	CERVICAL CANCER	
	YES	NO
Positive	109	488
Negative	31	7,926
	140	8,414
Sensitivity = 109/140 = 78%		
Specificity = 7,926/8,414 = 94%		

cervical cancer, but the Pap test was positive). Using the formula in Box 11-7, the sensitivity and specificity of the Pap test in this study were 78% and 94%, respectively.

Although sensitivity and specificity describe the characteristics of a test by correctly classifying those who have or do not have a disease, **predictive value** is a measure of the usefulness of a test in classifying people with disease. It can be calculated from the same basic data used to calculate sensitivity and specificity. More information on sensitivity, specificity, and predictive value can be obtained from most epidemiology and biostatistics textbooks.

Summary

This chapter defined the science of epidemiology and gave examples of how epidemiology is used in dentistry. Concepts and terms for measuring disease were introduced, as were study design models commonly used in epidemiology and oral epidemiology. The chapter also introduced the concepts of causality, risk, and risk factor. Now that you have a basic understanding of epidemiology, the next three chapters will focus on the application of epidemiology in the practice of dentistry, dental hygiene, and dental public health.

Learning Activities

1. Read the following three articles about the relationship between fluoridation and hip fractures and briefly describe the study design. Was it a descriptive study, an analytic study, a cohort study, or a case-control study? Which study provides the “best” data regarding the potential association?
 - a. Phipps KR, Orwoll ES, Mason JD, Cauley JA. Community water fluoridation, bone mineral density, and fractures: Prospective study of effects in older women. *BMJ* 2000;321:860–864.
 - b. Li Y, Liang C, Slemenda CW, et al. Effect of long-term exposure to fluoride in drink-

ing water on risks of bone fractures. *J Bone Miner Res* 2001;16:932–939.

- c. Hillier S, Cooper C, Killingray S, et al. Fluoride in drinking water and risk of hip fracture in the UK: A case-control study. *Lancet* 2000;355:265–269.
2. Go to the *American Journal of Epidemiology* web site (<http://aje.oupjournals.org/>) and search for articles that contain “oral cancer” in the title or abstract. Read one article relating to risk factors for oral cancer. What risk factors were studied? What type of study design was used? What was the association between the risk factor and oral cancer?
 3. The Cochrane Collaboration maintains a research glossary for consumers. Go to this glossary on the Web (<http://www.cochrane.org/resources/glossary.htm>) and look up the terms epidemiology, case-control study, causal effect, and cohort study. Look up three other terms not included in this chapter. Define the three additional terms and briefly describe how they relate to dental public health.
 4. Oral epidemiology is a viable career for dental hygienists. Go to the University of North Carolina’s Oral Epidemiology PhD Program web site and look at career options for oral epidemiologists (<http://www.dent.unc.edu/academic/programs/ade/epid/>).

Review Questions

1. When a disease is constantly and consistently present in a population it is referred to as:
 - a. pandemic.
 - b. prevalent.
 - c. epidemic.
 - d. incidental.
 - e. endemic.
2. When the incidence of a disease is unusually high for a population, it is referred to as:
 - a. pandemic.
 - b. prevalent.
 - c. epidemic.
 - d. incidental.
 - e. endemic.

3. Although a triangle has three sides, the epidemiologic triangle actually consists of four parts. Which of the following is not part of the epidemiologic triangle?
 - a. Time
 - b. Confounding variable
 - c. Environment
 - d. Agent
 - e. Host
4. Rates of death are called:
 - a. Morton rates.
 - b. Mortuary rates.
 - c. Mortality rates.
 - d. Morbidity rates.
 - e. Proportion rates.
5. Which of the following terms describes the number of new disease cases that have occurred during a specific period?
 - a. Incidence
 - b. Mortality
 - c. Proportion
 - d. Analytic
 - e. Prevalence
6. Incidence rates are generally used to describe the amount of dental caries in the United States. True or False?
7. Which study design is usually the first step in looking at a disease?
 - a. Experimental
 - b. Longitudinal
 - c. Prospective
 - d. Descriptive
 - e. Cohort
8. Which study design follows a group of individuals forward in time?
 - a. Retrospective cohort
 - b. Prospective cohort
 - c. Cross-sectional
 - d. Retrospective case-control
 - e. Horizontal cohort
9. The goal of any diagnostic or screening test is to have:
 - a. Sensitivity, 0%; Specificity, 0%
 - b. Sensitivity, 100%; Specificity, 0%
 - c. Sensitivity, 0%; Specificity, 100%

- d. Sensitivity and Specificity, 100%
- e. Sensitivity and Specificity, 50%

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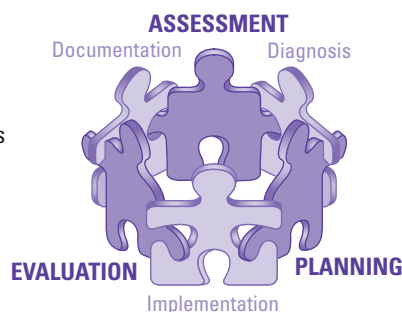
Applying Epidemiology in Public Health Practice: Oral Health Surveillance

12

Objectives

After studying this chapter and completing the study questions and activities, the learner will be able to:

- Discuss the measures that can be used to assess the oral health status of a community.
- Compare and contrast the clinical measures used in oral health surveillance.
- Describe the basic steps necessary to complete an oral health needs assessment.



KEY TERMS

Basic Screening Survey (BSS)

Calibration

Community Periodontal Index (CPI)

Dean's Fluorosis Index

df Index

dmf Index

DMF Index

Gingival Index (GI)

Interexaminer reliability

Intraexaminer reliability

Plaque Index (P1I)

Ramfjord Index Teeth

Reliability

Root Caries Index (RCI)

Simplified Oral Hygiene Index (OHI-S)

Surveillance

Tooth Surface Index of Fluorosis (TSIF)

Validity

See Appendix 3 for the ADEA competencies addressed in this chapter.¹

Introduction

As described in earlier chapters, assessment is one of the three core public health functions, together with policy development and assurance. In public health dentistry, one key element of assessment is the ongoing monitoring of a community's oral health status. The process of ongoing monitoring is more commonly known as **surveillance**, defined by the Centers for Disease Control and Prevention (CDC) as the ongoing systematic collection, analysis, and interpretation of outcome-specific data for use in the planning, implementation, and evaluation of public health practice.²

Information obtained through public health surveillance is used to assess public health status,

define public health priorities, evaluate programs, and conduct research.³ Simply, surveillance information tells you where the problems are, whom they affect, and where programmatic and prevention activities should be directed.

For an oral health surveillance system to be comparable between local, state, and national jurisdictions, it must be based on uniform data standards and measurements. This chapter presents standard methods for measuring dental caries, periodontal disease, dental fluorosis, treatment urgency, tooth loss, and other oral conditions in populations. The purpose of these measures is to describe the oral health of the community rather than the individual. For this reason, the methods outlined in this chapter

are appropriate for public health practice but may have little value in a clinical setting with an individual patient. In addition, certain oral health measures or indices are useful in a clinical setting, but are of little use in a community setting because they are too time consuming or have low reliability. Description of indices for individual patients (e.g., Plaque Control Record, Eastman Interdental Bleeding Index) can be found in most clinical dental hygiene textbooks.

National and state level oral health surveillance data are maintained in the National Oral Health Surveillance System (NOHSS). NOHSS is a collaborative effort between the Association of State and Territorial Dental Directors (ASTDD) and the CDC. Currently, there are eight oral health indicators included in NOHSS: caries experience, untreated caries, dental sealants, tooth loss, annual dental visits, teeth cleaning, fluoridation, and oral and pharyngeal cancer.

VALIDITY AND RELIABILITY

Most measures presented in this chapter are referred to as an “index.” An index is a graduated, numeric scale that has upper and lower limits, with scores on the scale corresponding to specific criterion for individuals or populations. In general, the higher the index score, the more disease will be present. For an index to be useful in public health practice, it must be both valid and reliable (also referred to as **validity** and **reliability**). To be valid, it must measure what it is intended to measure. For this reason, levels of the index should correspond with the stages of the disease under study. For a gingivitis index to be valid, it must measure the prevalence and severity of gingivitis rather than the prevalence and severity of some other condition.

Reliability refers to the ability of an index to consistently measure the same level of disease at different times by either the same or different examiners under various conditions. Reliability can also be thought of as repeatability, reproducibility, and consistency. For an index to be considered reliable, two different examiners should be able to obtain the same score for the

same person being examined. This is referred to as **interexaminer reliability**. In addition, one examiner should be able to obtain the same score if the same person is examined twice; referred to as **intraexaminer reliability**.

All of the indices presented in this chapter are considered valid. They are also considered to be reliable if the examiners are trained and calibrated. Training and **calibration** is an essential component of any community-based oral health needs assessment. The purpose of training examiners is to ensure that each person involved in the assessment is making consistent clinical judgments and to ensure uniform interpretation, understanding, and application of the codes and criteria for the various indices used.

To better understand the concept of reliability, consider each of your clinical dental hygiene instructors. Most hygiene students would agree that some instructors view (or grade) a clinical case differently from other instructors. To make each instructor grade a case in a similar manner (i.e., reliably), the instructors must have extensive training and regular calibration. In this case, instructor calibration would consist of each instructor independently examining several patients. The results would then be compared and adjustments made in how each instructor grades or scores a case so that all instructors agree on the final assessment. The calibration process can be quite lengthy and challenging to achieve the reliability desired.

SURVEILLANCE VERSUS CLINICAL DIAGNOSIS

Although dental public health surveillance activities often include an open-mouth examination, the examination process for surveillance and research differs significantly from a comprehensive clinical examination for the purpose of diagnosis and treatment planning. In most cases, a surveillance activity uses an abbreviated open-mouth examination, often referred to as a screening. A screening examination rarely includes radiographs and often looks at just one disease process, such as dental caries in children or periodontal disease in adults. In addition, most

screenings do not include the use of a dental explorer or periodontal probe and many only use a tongue blade and flashlight. For this reason, it is not appropriate to use screening examinations for the purpose of diagnosis or treatment planning. If a potential problem is identified during a screening, the individual should be referred to a dentist for a comprehensive examination.

It is also important to understand that surveillance activities can collect different levels of information at varying costs. For this reason, program budgets must be considered when deciding what type of information to collect. The more information collected, the more it will cost in terms of time for data collection, data entry, and data analysis.

MEASURING DENTAL CARIES

Dental caries is an infectious disease process that results in loss of tooth minerals (demineralization) on the outer surface of the tooth. If not controlled or remineralized at an early stage, caries can progress through the enamel, into the dentin, and eventually into the pulp. Dental caries occurs in both the primary and permanent dentitions and on both the coronal and root surfaces. Because of differences in the measurement of caries on coronal versus root surfaces, the measurement of each surface type will be addressed separately.

Coronal Caries

The traditional method for measuring caries experience—both present and past—on the coronal surface of the permanent dentition is the decayed, missing, and filled (DMF) Index. The **DMF Index**, which usually excludes the four third molars, counts either the number of teeth with a history of caries (DMFT: decayed, missing, and filled teeth) or the number of surfaces with a history of caries (DMFS: decayed, missing, and filled surfaces). After a systematic evaluation using a mouth mirror and good light source, each tooth or surface is scored as decayed, missing, or filled using the following diagnostic criteria: Decayed—loss of tooth structure at the enamel surface; Missing—tooth loss due to caries; and

Filled—restorative treatment resulting from caries. Note that because teeth lost as a result of orthodontic extraction or injury are missing for reasons other than caries, they are not counted as missing in the DMF Index.

An individual's DMFT score will be a whole number, ranging from 0 to 28 (if third molars are excluded); an individual's DMFS score will also be a whole number, ranging from 0 to 128. When calculating a DMFS score, the 16 posterior teeth are considered to have five surfaces and the 12 anterior teeth to have four surfaces ($[16 \times 5] + [12 \times 4] = 128$). The mean DMF score for a community is the total DMF score for all individuals divided by the number of people in the community ($[DMF^1 + DMF^2 + DMF^3 + \dots + DMF^n]/n$).

Although the DMF Index was designed to assess the coronal aspect of the permanent dentition, it has been modified for use in the primary dentition. The standard caries indices currently used in the primary dentition are the **df Index** and the **dmf Index**. The df Index counts either the number of decayed and filled primary teeth (dft) or the number of decayed and filled primary surfaces (dfs).

Because it is difficult to determine whether a primary tooth has been lost because of caries or natural exfoliation, missing teeth are often not included in this index. The df Index is generally used in children who are beginning to exfoliate their primary teeth (>5 years). Occasionally, you may see reference to the decayed, indicated for extraction, and filled (def) Index for caries in the primary dentition. The def Index will always have the same score as the df Index because the df Index combines decayed and indicated for extraction teeth into the same category. Most oral health surveillance programs will report a dft or dfs score rather than a def or defs score.

The dmf Index can be used in children who have not yet reached the age of natural exfoliation (<5 years) to assess the number of teeth (dmft) or surfaces (dmfs) that are decayed, missing because of dental caries, or filled. The original description of the dmft/dmfs Index, published in 1944, described the index as only being used in children ages 7 to 12 years.⁴ Today, the dmft/dmfs Index is generally used in preschool



BOX 12-1 Use of Upper and Lower Case Letters for Dental Caries Indices

- Upper case letters are used when caries indices refer to the permanent dentition (e.g., DMFT, DMFS).
- Lower case letters are used when caries indices refer to the primary dentition (e.g., dft, dfs, dmft, dmfs).

children, and the dft/dfs Index is used in children with mixed dentition. If you see reference to the dmft/dmfs only being used in older children, please note that this is no longer the case for oral health surveillance systems (Box 12-1).

The benefit of using a DMF Index to measure dental caries is that it provides a measure of disease severity in addition to an estimate of disease prevalence. However, a dental public health program is usually only interested in prevalence rather than severity of dental caries. The appropriate tool for measuring dental caries prevalence in a community is the **Basic Screening Survey (BSS)**, originally developed by the ASTDD in 1999.⁵ The BSS gathers information at a level consistent with monitoring the national health objectives found in the U.S. Public Health Services Healthy People document. In other words, the BSS gathers information on a per-person basis rather than on a per-tooth or per-tooth-surface basis. Each person screened is classified in a dichotomous manner (e.g., yes or no) as to whether or not they have treated decay or untreated dental caries. The oral health status for a community or population is then presented as the percentage of the population that has caries experience and untreated decay. For example, a recent statewide survey of third grade children in Connecticut found that 41% had caries experience and 18% had untreated decay.⁶ Although the DMF Index differentiates between permanent and primary teeth (DMF/dmf), the BSS model does not differentiate between the two. For example, if a child is classified as having

caries experience, the caries experience may be in their primary and/or permanent dentition. Note that for state level oral health data to be included in the NOHSS (www.cdc.gov/nohss), they must be based on a survey that followed the BSS model—DMF/dmf data are not included in the surveillance system.

The ASTDD BSS model does have one indicator for the primary dentition only—early childhood caries. This indicator is designed for preschool children. The six maxillary anterior teeth (central incisors, lateral incisors, and canines) are examined to determine if the child has untreated decay, a filling, or a tooth missing because of caries. If any of the six maxillary anterior teeth have caries experience, that child is classified as having early childhood caries.

Root Caries

A classification system similar to the DFT/DFS Index can be used to measure the prevalence and extent of root caries on exposed root surfaces. Each root or root surface is classified as being either decayed or filled. Unlike the indices for coronal caries, missing roots are not included in the total score for an individual. The problem with counting the number of decayed and/or filled roots is that the individual's score does not take into account the number of roots or root surfaces at risk. The **Root Caries Index (RCI)** is a measure of root caries that includes the number of exposed root surfaces as the denominator.⁷ The RCI is calculated by adding the number of decayed and filled root surfaces and then dividing this number by the number of root surfaces with gingival recession. This resulting number is then presented as a percentage, which means that it is multiplied by 100 (Box 12-2). If a person



BOX 12-2 Calculating the RCI⁷

$$\frac{\text{Decayed Root Surfaces} + \text{Filled Root Surfaces}}{\text{Number of Surfaces with Gingival Recession}} \times 100$$

has an RCI of 12%, it means that of their teeth with gingival recession, 12% of the root surfaces are either decayed or filled.

MEASURING PERIODONTAL STATUS

The **Community Periodontal Index (CPI)** is a quick, easy method for assessing and describing the overall periodontal status of a community.⁸ The CPI, which is promoted by the World Health Organization (WHO) and used throughout the world, evaluates three indicators of periodontal status—gingival bleeding, calculus, and periodontal pockets. It does not evaluate clinical loss of attachment. Until recently, the CPI was known as the Community Periodontal Index of Treatment Needs (CPITN). Changing patterns of periodontal treatment, however, have invalidated the treatment needs portion of the original index. For this reason, the index is now used to evaluate periodontal status rather than periodontal treatment needs.

The CPI uses a specially designed lightweight probe with a 0.5-mm ball tip and black bands between 3.5 and 5.5 mm and rings of 8.5 and 11.5 mm from the ball tip. In adults ages 20 years and older, 10 index teeth are evaluated: 2, 3, 8, 14, 15, 18, 19, 24, 30, and 31. In those younger



BOX 12-3 CPI—Codes and Criteria⁸

- 0: Healthy
- 1: Bleeding observed, directly or by using a mouth mirror, after probing
- 2: Calculus detected during probing, but all of the black band on the probe visible
- 3: Pocket 4–5 mm (gingival margin within the black band on the probe)
- 4: Pocket 6 mm or more (black band on probe not visible)
- X: Excluded segment (less than two teeth present)
- 9: Not recorded

than age 20, only six index teeth are examined: 3, 8, 14, 19, 24, and 30. After gently probing the index teeth, each tooth is scored according to the codes outlined in Box 12-3 and Figure 12-1.

In the early 1990s, a modified version of the CPITN—the Periodontal Screening and Recording (PSR)—was introduced in the United

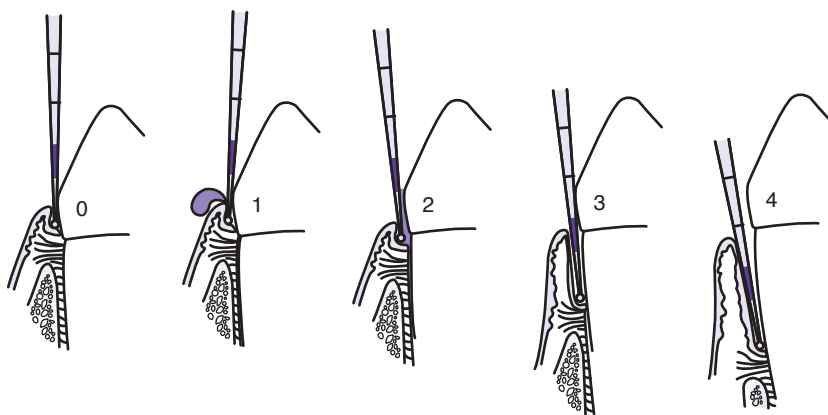


FIGURE 12-1 Examples of Community Periodontal Index coding, showing the position of the CPI probe. (From *Oral Health Surveys Basic Methods*. 4th ed. Geneva, Switzerland: WHO, 1997. Reprinted by permission of the WHO.)⁸

States.⁹ The PSR is designed for use with individual patients in a clinical setting rather than for community periodontal status assessment.

Another approach to evaluate the periodontal status of a community is to separately measure each individual aspect of periodontal disease. Using this approach, each of the following aspects of periodontal health would be measured—gingival bleeding, recession or loss of periodontal attachment, pocket depth, and plaque and calculus (as contributing disease factors). Because collecting each aspect of periodontal health is time consuming and expensive, this approach is rarely used by public health programs. This approach to measuring periodontal health in a community-based population is usually limited to research projects.

One of the most commonly used indices for assessing gingival bleeding is the **Gingival Index (GI)**.¹⁰ With the GI, a periodontal probe is inserted about 2 to 3 mm into the sulcus and gently “swept” around the tooth, rather than being “walked” around the tooth. The mesial, distal, buccal, and lingual surfaces of each tooth are then given a score of 0 to 3, based on the criteria described in Box 12-4.

There are no specific indices designed to measure loss of periodontal attachment or pocket depth. The tools used to measure these aspects



BOX 12-5 Scoring Loss of Attachment (LOA)—Codes and Criteria⁸

0:	LOA, 0–3 mm
1:	LOA, 4–5 mm
2:	LOA, 6–8 mm
3:	LOA, 9–11 mm
4:	LOA, 12 mm or more
X:	Excluded sextant
9:	Not recorded

of periodontal health in community-based surveys are the same as those used to measure periodontal status in a clinical practice. However, the WHO suggests the use of an ordinal scale for recording loss of periodontal attachment similar to the ordinal scale used for the CPI. Box 12-5 lists the codes and criteria recommended by the WHO for recording loss of attachment in community-based surveys.

Two indices have commonly been used to measure the presence of plaque and calculus: (i) the **Simplified Oral Hygiene Index (OHI-S)**, and (ii) the **Plaque Index (PII)**. The OHI-S evaluates both supragingival and subgingival plaque and calculus on six teeth: 3, 11, 14, 19, 24, and 30. Although commonly used in the past, the OHI-S is becoming obsolete as periodontal research focuses more on subgingival rather than supragingival plaque and calculus as periodontitis risk factors.

The PII was initially designed for use with the GI described earlier. As with the GI, the PII scores the mesial, distal, buccal, and lingual surface of each tooth on a scale from 0 to 3, based on the thickness of plaque at the gingival margin. The scoring criteria for the PII are shown in Box 12-6.

Completing a full-mouth periodontal status assessment on a group of individuals can be time consuming and cost prohibitive for many research projects and public health programs. For this reason, several methods have been developed that evaluate only a subset of teeth



BOX 12-4 GI—Codes and Criteria¹⁰

0:	Normal gingiva
1:	Mild inflammation (slight edema and change in color; no bleeding on probing)
2:	Moderate inflammation (redness and edema; bleeding on probing)
3:	Severe inflammation (marked redness and edema; ulceration; tendency to spontaneous bleeding)



BOX 12-6 P1—Codes and Criteria¹⁰

- 0: No plaque
- 1: A film of plaque adhering to the free gingival margin and adjacent area of the tooth. The plaque may be recognized only by running a probe across the tooth surface.
- 2: Moderate accumulation of soft deposits within the gingival pocket that can be seen with the naked eye or on the tooth and gingival margin.
- 3: Abundance of soft matter within the gingival pocket and/or on the tooth and gingival margin.

in the mouth. One such method was developed in the 1950s by Dr. Sigurd P. Ramfjord.¹¹ Using this method, periodontal assessments are only completed on six teeth, known as the “Ramfjord Teeth” or the **“Ramfjord Index Teeth.”** These six teeth include the maxillary right first molar, left central incisor, left first premolar, mandibu-

lar left first molar, right central incisor, and right first premolar (or teeth 3, 9, 12, 19, 25, and 28).

The partial-mouth method used in the National Health and Nutrition Examination Survey (NHANES) from 2001 to 2004 evaluated two randomly selected quadrants—one maxillary and one mandibular. For each tooth in these randomly selected quadrants, measures were taken at only three sites, the mesiobuccal, buccal, and distobuccal.¹² Although completing partial-mouth periodontal assessments are not appropriate for clinical settings because of the localized nature of periodontal disease, they do provide valuable and appropriate information for oral health surveillance and the monitoring of disease trends in populations.

When reading older dental literature regarding the prevalence and severity of periodontal disease, you may see references to periodontal indices not included in this section. Because our understanding of periodontal disease has changed significantly in the past 20 years, many previously used indices for measuring periodontal status are now obsolete. Three such obsolete indices are the Periodontal Index (PI), Periodontal Disease Index (PDI), and the Papillary Marginal Attached (PMA) Index (although they may still be included in some dental hygiene textbooks).



BOX 12-7 Dean's Fluorosis Index—Codes and Criteria¹³

- 0: **Normal**—The enamel surface is smooth, glossy, and usually a pale, creamy-white color.
- 1: **Questionable**—The enamel shows slight aberrations from the translucency of normal enamel that may range from a few white flecks to occasional spots.
- 2: **Very Mild**—Small, opaque, paper-white areas scattered irregularly over the tooth but involving less than 25% of the labial tooth surface.
- 3: **Mild**—The white opacity of the enamel of the teeth is more extensive than for code 2, but covers less than 50% of the tooth surface.
- 4: **Moderate**—The enamel surfaces of the teeth show significant wear, and brown stain is frequently a disfiguring feature.
- 5: **Severe**—The enamel surfaces are badly affected and hypoplasia is so significant that the general form of the tooth may be affected. There are pitted or worn areas, and brown stains are widespread; the teeth often have a corroded appearance.



BOX 12-8 TSIF—Codes and Criteria¹⁴

- 0: Enamel shows no evidence of fluorosis.
- 1: Enamel shows definite evidence of fluorosis, namely areas with parchment-white color that total less than one third of the visible enamel surface. This category includes fluorosis confined only to incisal edges of anterior teeth and cusp tips of posterior teeth.
- 2: Parchment-white fluorosis totals at least one third but less than two thirds of the visible surface.
- 3: Parchment-white fluorosis totals at least two thirds of the visible surface.
- 4: Enamel shows staining in conjunction with any of the preceding levels of fluorosis. Staining is defined as an area of definite discoloration that may range from light to dark brown.
- 5: Discrete pitting exists of the enamel, unaccompanied by evidence of staining of intact enamel. A pit is defined as a definite physical defect in the enamel surface, with a rough floor surrounded by a wall of intact enamel. The pitted area is usually stained or differs in color from the surrounding enamel.
- 6: Both discrete pitting and staining exist of the intact enamel.
- 7: Confluent pitting exists of the enamel surface. Large areas of enamel may be missing, and the anatomy of the tooth may be altered. Dark brown stain is usually present.

MEASURING DENTAL FLUOROSIS

During tooth development, ingested fluoride becomes incorporated in the enamel structure of the tooth. If excessive amounts of fluoride are ingested, dental fluorosis can develop. Dental fluorosis is defined as hypomineralization of the dental enamel caused by excessive ingestion of fluoride during tooth development. The appearance of dental fluorosis varies, depending on the quantity and timing of fluoride ingestion. It can range from barely noticeable to noticeable brown staining and pitting of the enamel.

Several indices measure the prevalence and severity of dental fluorosis. The most common are **Dean's Fluorosis Index**¹³ and the **Tooth Surface Index of Fluorosis (TSIF)**.¹⁴ With Dean's Fluorosis Index, the score for an individual is made on the basis of the two most affected teeth. If the two teeth are not equally affected, the score for the less affected of the two teeth is recorded. Although the Dean's Fluorosis Index only records the score for the two most affected teeth, the TSIF gives a score for each tooth

surface in the mouth. The TSIF provides more comprehensive information on the amount and distribution of dental fluorosis for an individual; however, it is time consuming and the WHO recommends that community surveys use Dean's Fluorosis Index. The codes and criteria for Dean's Fluorosis Index and the TSIF are listed in Boxes 12-7 and 12-8.

MEASURING TREATMENT URGENCY

Many public health programs are not necessarily interested in the level of oral disease, but they may be interested in the proportion of the population that is in need of various levels of dental care. Two different organizations have developed criteria for quantifying treatment urgency. The first is the American Dental Association (ADA), which developed a four-level treatment urgency scale in the 1950s.¹⁵ The second organization is the ASTDD, which developed a three-level treatment urgency scale in 1999.⁵ Most public health programs now use the ASTDD scale because of its improved reliability. Box 12-9 lists the criteria for each treatment urgency scale.



BOX 12-9 ASTDD and ADA Treatment Urgency Scales—Codes and Criteria^{5,15}

ASTDD Treatment Urgency Scale:

- 0: No obvious problems. Routine dental care is recommended at next regular checkup.
- 1: Early dental care is recommended within several weeks. Caries without accompanying signs or symptoms, individuals with spontaneous bleeding of gums, suspicious white or red soft tissue area, or ill-fitting dentures.
- 2: Urgent/emergency care is recommended within 24 hours. Signs or symptoms include pain, infection, swelling, or soft tissue ulceration of more than 2 weeks' duration (determined by questioning).

ADA Treatment Urgency Scale:

- 1: Apparently requires no dental treatment
- 2: Requires treatment, but not of an urgent nature
- 3: Requires early treatment
- 4: Requires immediate dental treatment

MEASURING TOOTH LOSS

Tooth loss is one of the few oral health conditions that can be reliably measured through an open-mouth examination or a self-administered questionnaire. When measuring tooth loss, however, a distinction must be made between loss of certain permanent teeth and total tooth loss. Total tooth loss, or loss of all natural teeth, is also referred to as edentulism.

A state-based, ongoing data collection program designed to measure behavioral risk factors in U.S. adults—the Behavioral Risk Factor Surveillance System (BRFSS)—monitors tooth loss through a telephone survey. Each month, states select a random sample of adults for a telephone interview. This selection process results in a representative sample for each state so that statistical inferences can be made from the collected information.¹⁶

In 1999, 2002, 2004, 2006, and 2008, all states asked a core set of oral health questions to obtain information on time since last dental visit, time since last tooth cleaning, and tooth loss. The following question was used to determine the prevalence and severity of tooth loss in U.S. adults.¹⁷

- Question: How many of your permanent teeth have been removed because of tooth decay or gum disease? Include teeth lost to infection, but do not include teeth lost for other reasons, such as injury or orthodontics.
- Response: None; 5 or fewer; 6 or more, but not all; all.

MEASURING ORAL AND PHARYNGEAL CANCER

As with other cancers, oral and pharyngeal cancer is usually expressed as a rate or proportion. For example, the 2005 age-adjusted incidence rate for cancers of the oral cavity and pharynx was 14.7 per 100,000 population for White males and 15.1 per 100,000 population for Black or African American males.¹⁸ There are two primary methods for measuring mortality and morbidity from oral and pharyngeal cancer: (i) mortality rates, and (ii) incidence rates. Mortality (death) rates from cancers of the oral cavity and pharynx are generated by the CDC's National Center for Health Statistics (NCHS), which obtains data from death certificates collected through the

National Vital Statistics System. Mortality data, together with other vital statistics data, can be obtained from the NCHS web site.

Information for the calculation of cancer incidence rates is obtained through a network of local and state cancer registries that receives reports of new cancer cases from physicians and hospitals. Eighteen such population-based cancer registries (American Indians in Arizona, Atlanta, Connecticut, Detroit, Greater California, Hawaii, Iowa, Kentucky, Los Angeles, Native Americans in Alaska, New Jersey, New Mexico, New Orleans, San Francisco-Oakland, San Jose-Monterey, Seattle-Puget Sound, Rural Georgia, and Utah) participate in the Surveillance, Epidemiology, and End Results (SEER) program, which is conducted by the National Institutes of Health, National Cancer Institute. SEER is the primary source of all cancer incidence data in the United States.

HOW TO COMPLETE A COMMUNITY-BASED ORAL HEALTH NEEDS ASSESSMENT

Although this chapter provides basic information on dental indices and other measures of oral health, it does not provide detailed information on how to complete an oral health survey. Planning and implementing a comprehensive community-level oral health survey is an arduous task that is beyond the scope of this text. There are, however, three guides that give detailed information on how to complete an oral health assessment. The first is *Assessing Oral Health Needs: ASTDD Seven-Step Model* developed and produced by the ASTDD.¹⁹ The Seven-Step Model was described in Chapter 5 and gives detailed information on how to conduct a comprehensive needs assessment, ranging from the evaluation of existing data to the collection of new data.

Two other resources provide detailed information on how to implement an open-mouth survey. They are *Oral Health Surveys: Basic Methods*,⁸ published by the WHO, and *Basic Screening Surveys: An Approach to Monitoring Community Oral Health*,⁵ published by the ASTDD. Both references are extremely useful;

however, *Basic Screening Surveys: An Approach to Monitoring Community Oral Health* provides the most practical information for monitoring the Healthy People oral health objectives. *Basic Screening Surveys: An Approach to Monitoring Community Oral Health* is available for downloading from the ASTDD web site listed in the Resources section.

Summary

This chapter introduced the concept of oral health surveillance and described methods commonly used to measure the prevalence of dental caries, periodontal disease, dental fluorosis, tooth loss, and treatment urgency in a community setting. Using these methods, together with the needs assessment information presented in earlier chapters, you will be able to evaluate the oral health status of the community that you serve.

Learning Activities

1. Go to the National Oral Health Surveillance System web site (www.cdc.gov/nohss). Look up the proportion of adults ≥ 65 who have lost all of their teeth. Compare the prevalence of total tooth loss in your state with the national prevalence.
2. Go to the CDC's NCHS web site (www.cdc.gov/nchs). Look up the age-adjusted death rate for malignant neoplasms of the lip, oral cavity and pharynx. Has the age-adjusted death rate changed over time?
3. Download the Basic Screening Survey manual from the Association of State and Territorial Dental Directors' web site (www.astdd.org). Conduct an oral health survey of your class. What proportion of the class has treated dental caries? What proportion of the class has dental sealants on their permanent molars?
4. Refer to Learning Activity 3. Have several different students independently conduct the oral health survey then compare your individual findings. Do the different "examiners" agree on the score for each person examined?

In those cases where you do not agree, have all of the examiners reassess the person and determine how you need to adjust your scores so that you all agree.

Resources

National Center for Health Statistics: <http://www.cdc.gov/nchs>
Surveillance, Epidemiology, and End Results (SEER) Program: <http://www.seer.cancer.gov>
National Oral Health Surveillance System: <http://www.cdc.gov/nohss>
ASTDD Basic Screening Surveys: An Approach to Monitoring Community Oral Health: <http://www.astdd.org>
Periodontal Screening and Recording (PSR) procedure: <http://www.ada.org>
Oral Health Surveys: Basic Methods: <http://www.who.int>
Behavioral Risk Factor Surveillance System: <http://www.cdc.gov/brfss>

Review Questions

- What does the abbreviation DMFS mean?
 - Decayed, missing, and filled tooth surfaces
 - Decayed, missing, and filled permanent teeth
 - Decayed, missing, and filled primary tooth surfaces
 - Decayed, missing, and filled permanent tooth surfaces
 - Decayed, missing, and filled primary teeth
- A 16-year-old has occlusal decay on #2 and #15, occlusal fillings on all four first molars, an MOD filling on #18, and an MO filling on #31. Teeth #5 and #12 are missing. What are the DMFT and DMFS scores for this adolescent?
 - DMFT 10; DMFS 21
 - DMFT 7; DMFS 12
 - DMFT 8; DMFS 11
 - DMFT 4; DMFS 4
- DMFS measures caries experience in permanent teeth, and dmfs measures caries experience in the primary dentition.
 - True
 - False
- If a person has a RCI of 25%, it means that 25% of their teeth have decay or fillings on the roots.
 - True
 - False
- The CPI evaluates three indicators of periodontal status. What are they?
 - Plaque, calculus, and attachment loss
 - Plaque, calculus, and periodontal pockets
 - Gingival bleeding, plaque, and attachment loss
 - Gingival bleeding, calculus, and periodontal pockets
 - Gingival bleeding, calculus, and attachment loss
- For adults, how many teeth does the CPI evaluate?
 - 6
 - 8
 - 10
 - 14
 - 28
- The OHI-S is the best index for evaluating plaque and calculus.
 - True
 - False
- A 12-year-old child is being examined for dental fluorosis using Dean's Fluorosis Index. She has mild fluorosis on teeth #8 and #9 and very mild fluorosis on teeth #3, 14, 18, and 30. How would she be classified in terms of fluorosis?
 - Questionable
 - Very mild
 - Mild
 - Moderate
 - Severe
- Which of the following can be easily measured through a questionnaire or survey?
 - Untreated decay
 - Caries experience

- c. Tooth loss
 - d. Treatment urgency
 - e. Dental sealants
10. What are the two primary methods for measuring mortality and morbidity from oral and pharyngeal cancer?
- a. Morbidity rates and prevalence rates
 - b. Mortality rates and prevalence rates
 - c. Morbidity rates and incidence rates
 - d. Mortality rates and incidence rates
 - e. Mortuary rates and incidence rates

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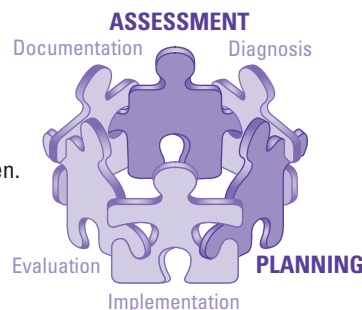
Oral Disease Patterns in the United States

13

Objectives

After studying this chapter, and completing the study questions and activities, the learner will be able to:

- Describe trends in overall oral health during the past 20 years.
- Describe the prevalence of dental caries and dental fluorosis in U.S. children.
- Describe the prevalence of dental caries, periodontitis, and tooth loss in U.S. adults.
- Describe the prevalence of oral and pharyngeal cancer in the United States.
- Outline the disparities in oral health status in the United States.
- Discuss the determinants of oral disease in humans.



KEY TERMS

Behavioral Risk Factor

Surveillance System (BRFSS)

Cleft lip

Cleft palate

Dental caries

Dental fluorosis

Federal poverty level (FPL)

Gingivitis

National Health and Nutrition

Examination Survey (NHANES)

Oral and pharyngeal cancer

Periodontitis

Tooth loss

Total tooth loss

Trends

See Appendix 3 for the ADEA competencies addressed in this chapter.¹

Introduction

Between 1971 and 1974, the National Center for Health Statistics of the Centers for Disease Control and Prevention conducted the first **National Health and Nutrition Examination Survey (NHANES)**—a nationwide survey designed to measure and monitor indicators of nutrition and health among U.S. citizens. Data from the third NHANES survey—NHANES III—were collected between 1988 and 1994 and another round of NHANES data were collected between 1999 and 2004. Because all of these surveys included a dental component, the information obtained can be used to evaluate the current oral health status of the U.S. population,

in addition to evaluating changes in oral health status over time (**trends**). Using data from NHANES and other sources, this chapter focuses on the current oral health status of the U.S. population, together with trends in oral health status over time. In addition, this chapter highlights those population subgroups identified as having oral health disparities.

DENTAL CARIES

Dental Caries in Children

During the 20 or so years between NHANES I and NHANES 1999–2004, there was a significant decrease in permanent tooth **dental caries**

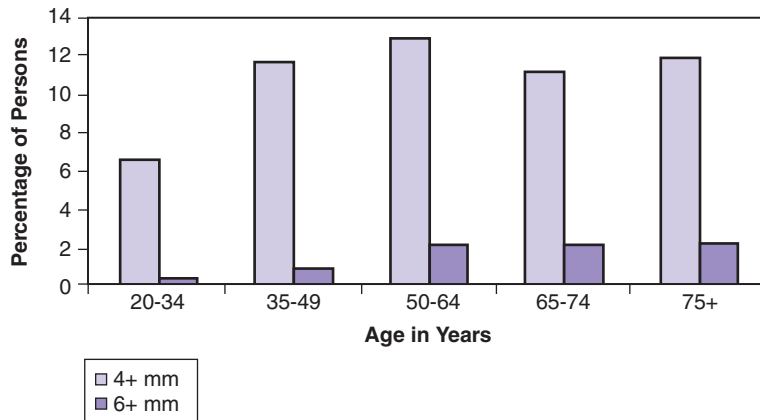


FIGURE 13-1 Mean DMFT and dft for children ages 6 to 18 and ages 2 to 5. NHANES I (1971–1974), NHANES III (1988–1994) and NHANES 1999–2004.²⁻⁴

experienced by U.S. school children (≥ 6 years) along with an increase in the proportion of caries-free children. As presented in Figure 13-1, the number of decayed, missing, and filled permanent teeth (DMFT) in children ages 6 to 18 years decreased by approximately 67%; from 4.44 in 1971–1974 to 1.46 in 1999–2004.^{2,3} Although caries rates declined in U.S. school children age 6 and older, preschool children ages 2 to 5 years did not experience the same decline. In fact, between 1988–1994 and 1999–2004 dental caries in primary teeth increased slightly.⁴

In addition to the decline in permanent tooth caries, the amount of untreated decay in U.S. children also decreased. Overall, the number of decayed permanent teeth among children ages 6 to 18 years decreased by 78%; from 1.43 in 1971–1974 to 0.29 in 1999–2004.^{3,5} For younger children, ages 2 to 10 years, the number of decayed primary teeth decreased by 52%; from 1.42 to 0.68.^{3,5}

Although there has been a reduction in overall caries rates, the reduction has not occurred evenly across all tooth surfaces. The reduction has been proportionately greater in interproximal and smooth surfaces than in pit and fissure surfaces. For all age, sex, race, and ethnic groups, the occlusal surface is the most commonly filled or decayed tooth surface.

Even though national surveys have demonstrated a decline in the overall level of clinically detectable dental caries in U.S. children, caries is still one of the most common childhood diseases—five times as common as asthma and seven times as common as hay fever in 5 to 17 year olds.⁶ Dental caries, however, is not evenly distributed among U.S. children. About 80% of permanent teeth affected by caries are found in about 25% of children ages 5 to 17 years.⁷ In the United States, dental caries in both the primary and permanent dentition is disproportionately concentrated in children from low-income households and ethnic minority groups. This is especially true for untreated decay. This disproportional concentration of caries in low-income and minority populations is referred to as an oral health disparity.

Figure 13-2 presents the proportion of children with untreated decay in their primary and permanent teeth stratified by income level, using 200% of the **federal poverty level (FPL)** as the income cut point. Compared with higher income children (income above 200% FPL), a higher proportion of lower income children (income at or below 200% FPL) have untreated decay. For children ages 2 to 11 years, about 30% of lower income children have untreated decay in their primary dentition compared with 15% of higher

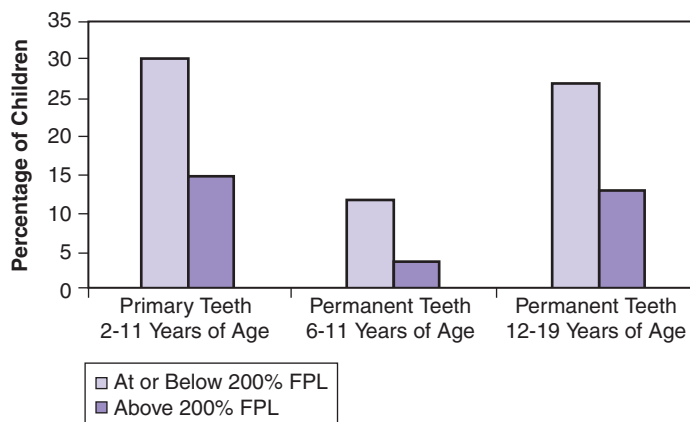


FIGURE 13-2 Percentage of children with untreated decay by income level, NHANES 1999–2004.⁴

income children. A similar difference can be seen in the permanent teeth of adolescents ages 12 to 19 years; 27% of the lower income children have untreated decay compared with 13% of the higher income children.⁴

Differences in the proportion of children with decay experience and untreated decay, stratified by race and ethnicity, is presented in Table 13-1. Compared with non-Hispanic White children, Hispanic, African American, and American Indian or Alaska Native children are more likely to have both decay experience and untreated decay.

Dental Sealants

As previously stated, the decline in childhood caries has been disproportionately higher in smooth surfaces compared with pit and fissure surfaces. For this reason, dental sealants continue to play an important role in the prevention of caries. Unfortunately, the national prevalence of dental sealants in U.S. children is relatively low with 32% of children age 8 and 21% of children age 14 having at least one dental sealant on a permanent molar.⁸ Data from state oral health surveys, however, suggest that the prevalence of

TABLE 13-1 PERCENTAGE OF CHILDREN WITH DECAY EXPERIENCE AND UNTREATED DECAY STRATIFIED BY RACE AND ETHNICITY

	PERCENTAGE WITH DECAY EXPERIENCE			PERCENTAGE WITH UNTREATED DECAY		
	2–4 YEARS	6–8 YEARS	15 YEARS	2–4 YEARS	6–8 YEARS	15 YEARS
TOTAL+	24	53	56	19	29	18
White non-Hispanic+	20	49	56	16	25	15
African American+	26	56	53	20	37	25
Mexican American+	35	69	58	28	41	21
American Indian or Alaska Native++	76	91	88	68	72	69

From Healthy People 2010 Database. Available at: <http://wonder.cdc.gov/data2010>. Accessed December 2008.⁸

+ NHANES III, 1999–2004.

++ Oral Health Survey of Native American Dental Patients, 1999.

sealants is higher in some states. For example, in their 2005 statewide oral health survey, the Washington State Department of Health found that 50% of third grade children had sealants.⁹ Other state surveys have found the prevalence of sealants in third grade children ranges from 20% to 66%, with the majority of states reporting a prevalence of between 35% and 60%.¹⁰

Similar to dental caries, there are disparities in access to and prevalence of preventive dental sealants. On a national level, a significantly higher percentage of non-Hispanic Whites have sealants in comparison with their non-Hispanic Black and Mexican American counterparts.⁵

Dental Caries in Adults

When considering the distribution of dental caries in adults, a distinction must be made between coronal and root caries. In terms of coronal caries, most dentate adults have some evidence of treated or untreated decay. Of the dentate adults (20–64 years) examined in NHANES 1999–2004, 92% had experienced coronal caries.⁴ Figure 13-3 presents the mean number of decayed and filled surfaces (DFS) for dentate adults, stratified by age and sex. As age increases, mean DFS also increases. In persons ages 20 to 39 years, mean DFS was 12.1; DFS was 29.6 in those ages 60 and older. For each age group, females had a slightly

higher mean DFS than males, although males were more likely to have a higher percentage of untreated coronal surfaces.¹¹

Unlike children, there are not large differences in overall caries rates between adults of different racial/ethnic groups. There are, however, racial and ethnic disparities in the prevalence of untreated decay and the number of surfaces with untreated decay. Twenty-one percent of non-Hispanic Whites have untreated decay compared with 40% of non-Hispanic Blacks and 38% of Mexican Americans.⁴

As would be expected, root caries prevalence increases significantly with age ranging from 8% in persons ages 20 to 34 years to 43% of those ages 75 years or older. As with coronal caries, non-Hispanic Whites had a lower prevalence of untreated root caries (12%) compared with non-Hispanic Blacks (31%) or Mexican Americans (30%).⁴ Unlike coronal caries, however, more 20- to 64-year-old men (16%) had evidence of root caries than similarly aged women (13%).⁴

As with decay rates in the permanent teeth of children, the amount of coronal caries in adults has decreased. Among adults ages 20 to 64 years, the mean DMFS decreased from 39.7 in 1988–1994 to 30.9 in 1999–2004; a decline of 22%.⁴ When stratified by age, the youngest age cohort had the most improvement, with a 29% decline in persons ages 20 to 34 years ($p < 0.05$), a 25% decline in those ages 35 to 49 years ($p < 0.05$), and a 16% decrease for adults ages 50 to 64 years ($p > 0.05$). A decline in caries was noted in all racial groups and in all income groups except for those living below the federal poverty level.⁴

Although the prevalence of dental caries remained unchanged for seniors (65+ years) between 1988–1994 and 1999–2004, the presence of untreated decay decreased for seniors across most of the major demographic subgroups. This downward trend was most noteworthy for non-Hispanic black seniors (54% in 1988–1994 versus 37% in 1999–2004). Overall, the prevalence of root caries among seniors decreased by 20%; from 46% in 1988–1994 to 37% in 1999–2004. This decrease was observed for most of the major demographic subgroups except non-Hispanic black and Mexican American seniors.⁴

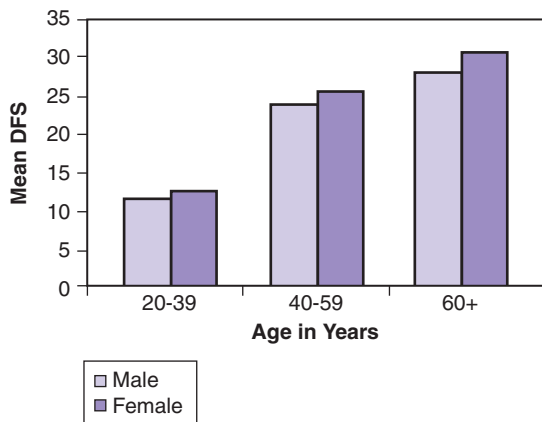


FIGURE 13-3 Mean number of decayed and filled coronal surfaces (DFS) by age and sex (U.S. population ages 20 years and older, 1999–2002).¹¹

Risk Factors for Dental Caries

As previously stated, children from low-income and minority populations have a higher prevalence of dental caries and the prevalence and severity of caries in adults tends to increase with age and vary by sex. Dental caries is a complex, multifactorial disease, and several other factors have been associated with the prevalence of dental caries in both children and adults. Salivary flow and composition play an important role in dental caries,¹² as does an individual's diet and intake of fermentable carbohydrates in foods and beverages.¹³ Because caries is the result of a bacterial infection, the types and amounts of oral bacteria influence caries rates,¹⁴ and limited data suggest that there may also be familial tendencies or genetic influences.¹⁵ Last, but not least, is the important role of fluoride in the prevention of dental caries.¹⁶

DENTAL FLUOROSIS

With the substantial decline in the prevalence and severity of dental caries among U.S. children and young adults, there has been a corresponding increase in the prevalence of **dental fluorosis**. The U.S. National Fluorosis Survey, conducted by the National Institute of Dental Research in 1986–1987, found that 23% of children ages 6 to 19 years had some degree of dental fluorosis, with the majority of the cases (76%) classified as very mild.¹⁷ Approximately 16% of children in fluoride-deficient communities had fluorosis compared with 29% in fluoridated communities.¹⁷ An analysis of NHANES data collected between 1999 and 2002 found a nine percentage point increase in the prevalence of fluorosis in children and adolescents ages 6 to 19; from 23% in 1986–1987 to 32% in 1999–2002.¹⁸

An in-depth review of all published studies of the prevalence and severity of enamel fluorosis in North American children found a clear increase in fluorosis among populations with drinking water containing less than 0.3 ppm fluoride.¹⁹ This same review also found that an increase in the prevalence of fluorosis in those drinking optimally fluoridated water likely has

occurred as well, although the evidence for such a trend is not as clear as for fluoride-deficient communities.

Risk Factors for Dental Fluorosis

It is well documented that the prevalence of fluorosis is a direct result of the amount of fluoride ingested during tooth development, although some studies suggest the possibility of a genetic predisposition to dental fluorosis.²⁰ Excess fluoride ingestion may come from various sources, including fluoridated toothpaste, fluoride supplements, fluoridated water, or a combination of sources.

PERIODONTAL DISEASE

When the epidemiology of periodontal diseases is considered, a distinction must be made between **gingivitis** and **periodontitis**. Gingivitis is a reversible inflammation of the gingival tissue, which is generally assessed in community-based studies by the presence or absence of gingival bleeding. In populations, gingivitis is found in early childhood and becomes more prevalent and severe in adolescence, with the prevalence leveling off somewhat after adolescence.²¹ The NHANES III (1988–1994) survey found that 73% of adolescents ages 13 to 17 years had at least one site with gingival bleeding. The prevalence of gingival bleeding decreased to 66% of young adults ages 18 to 24 years and then stayed at about 60% to 63% in adults ages 25 years and older.²² It is generally believed that the prevalence of gingivitis has declined over recent years in the United States, mainly because of greater attention to oral hygiene.²³

The prevalence and severity of periodontitis in the United States is assessed in national surveys by evaluating clinical loss of attachment (LOA) and pocket depth at the mesiobuccal and midbuccal sites of one mandibular and one maxillary quadrant. NHANES 1999–2004 found that approximately 25% of persons ages 20 to 64 years had destructive periodontal disease, defined as having a LOA at one or more sites of at least 4 mm.⁴ The prevalence of more

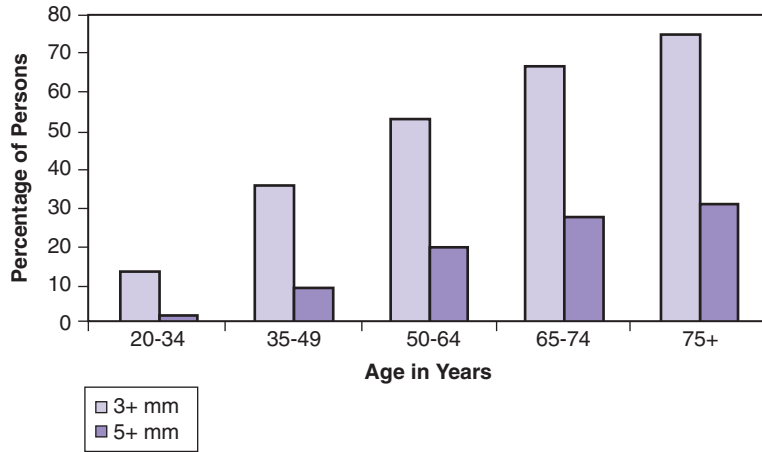


FIGURE 13-4 Prevalence of clinical loss of attachment of ≥ 3 mm and ≥ 5 mm by age (U.S. population, ages 20 years and older, 1999–2004).⁴

advanced attachment loss (≥ 5 mm) increased with age, ranging from 2% of young adults ages 20 to 34 years to 31% of seniors ages 75 years and older (Fig. 13-4).

In regard to periodontal pocketing, 10% of persons ages 20 to 64 years had periodontal pockets of ≥ 4 mm, whereas 1% had pockets of ≥ 6 mm. Unlike clinical LOA, there was not a clear increase in the prevalence of periodontal pockets with age (Fig. 13-5), although persons older than 49 had a slightly higher percentage of sites with deep pockets.⁴

For all ages, females tended to have better periodontal health. Thirty-eight percent of males 20 to 64 compared with 27% of females had LOA of ≥ 3 mm, whereas 13% of males compared with 8% of females had periodontal pockets of ≥ 4 mm. With regard to race and ethnicity, non-Hispanic Whites exhibited better periodontal health than either non-Hispanic Blacks or Mexican Americans. Seven percent of non-Hispanic Whites compared with 21% of non-Hispanic Blacks and 17% of Mexican Americans had periodontal pockets of ≥ 4 mm.⁴

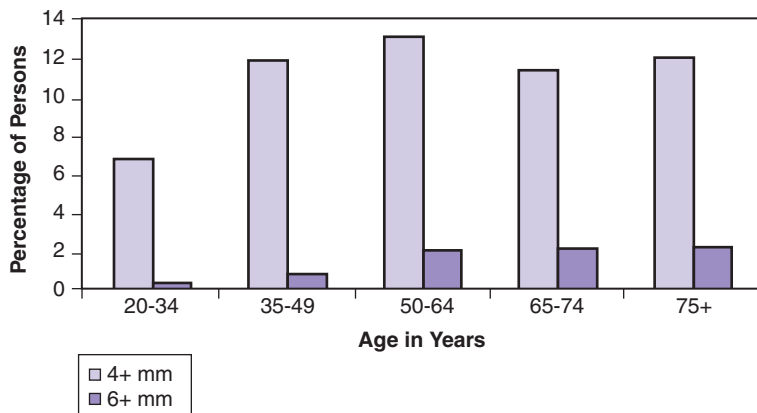


FIGURE 13-5 Prevalence of pocket depth of ≥ 4 mm and ≥ 6 mm by age (U.S. population, ages 20 years and older, 1999–2004).⁴

Risk Factors for Periodontal Disease

Smoking is a major risk factor in the United States for periodontitis, and a report suggests that smoking may be responsible for more than one half of all periodontitis cases among adults.²⁴ Other known risk factors include several systemic diseases, including Chediak–Higashi syndrome, Down syndrome, Ehlers–Danlos syndrome, and Papillon–Lefevre syndrome. In addition, insulin-dependent diabetes and acquired immunodeficiency syndrome may exacerbate the effects of existing disease.²³

TOOTH LOSS IN ADULTS

During the past several decades, there has been a steady decline in the prevalence of **tooth loss** and **total tooth loss** (edentulism) in the United States.²⁵ In the 30-year period from 1958 to 1988, the prevalence of total tooth loss in adults ages 75 years and older declined by 34%, from 67% in 1957–1958 to 44% in 1988–1991.^{26,27} The most current information on total tooth loss in the United States is from the **Behavioral Risk Factor Surveillance System (BRFSS)**. The 2004 BRFSS survey found that 20.5% of adults ages 65 years and older were edentulous, with the prevalence varying by education, sex, income, and race. In general, older adults who have less than 12 years of education or have an annual income of less than \$15,000 have a higher prevalence of total tooth loss.²⁸

In terms of tooth retention, NHANES 1999–2004 found that 38% of adults ages 35 to 44 had retained all 28 teeth.⁴ As would be expected, age is strongly related to both tooth retention and tooth loss. Adults between ages 20 and 34 years have an average of 26.9 teeth; persons ages 50 to 64 years average 22.3 teeth; and those 75 years or older average 18.4 teeth.⁴ The prevalence of total tooth loss increases from 10% in persons ages 50 to 64 years to 31% in those 75 years or older.⁴

ORAL AND PHARYNGEAL CANCER

Cancer of the oral cavity and pharynx, which accounts for about 3% to 4% of all cancers in the United States, includes tumors of the lip,

tongue, gingival tissue, floor of the mouth, soft and hard palate, tonsils, salivary glands, oropharynx, nasopharynx, hypopharynx, and other less frequent sites.²⁹ In 2005, **oral and pharyngeal cancer** accounted for approximately 35,310 new cases and 7,590 deaths in the United States.³⁰ Except for salivary gland tumors, which are rare, almost all oral cancers are squamous cell carcinomas. The overall 5-year relative survival for oral cancer has remained stable at 40% to 50% for several decades.³¹

In Americans, the incidence of oral cancer is threefold higher among men than women, and more than 90% of cases occur in persons older than age 45.³² Like most epithelial tumors, risk of oral cancer increases with age. This cancer occurs more frequently in Blacks than Whites. During 2001 to 2005, the average annual age-adjusted incidence rate for oral cancer in the United States was 15.7 cases per 100,000 person-years among White men; 6.1 among White women; 17.2 among Black men; and 5.9 among Black women (Fig. 13-6).³⁰ During the past decade, the incidence of cancer at the base of the tongue and the tonsils has increased, especially in people younger than 45 years.³³ This change has been attributed to the increasing prevalence of human papillomavirus (HPV) infection in developed countries.³³ In this country, differences in alcohol and tobacco use account for most of the racial differences in oral cancer.³⁴ As with incidence rates, mortality rates for oral and pharyngeal cancer are highest among Black males, followed by White males (Fig. 13-7).

Risk Factors for Oral and Pharyngeal Cancer

Tobacco and alcohol account for approximately three-fourths of all oral cancers in the United States, and recent epidemiologic evidence indicates that smoking and drinking are independent risk factors for oral cancer that produce a synergistic effect when combined.³² For example, a person who has a more than 40 pack-year history of smoking and who consumes five alcoholic drinks per day has a 40-fold increased risk.³⁵

Dietary factors are also important risks for oral cancers with numerous epidemiological studies finding an association between oral cancer,

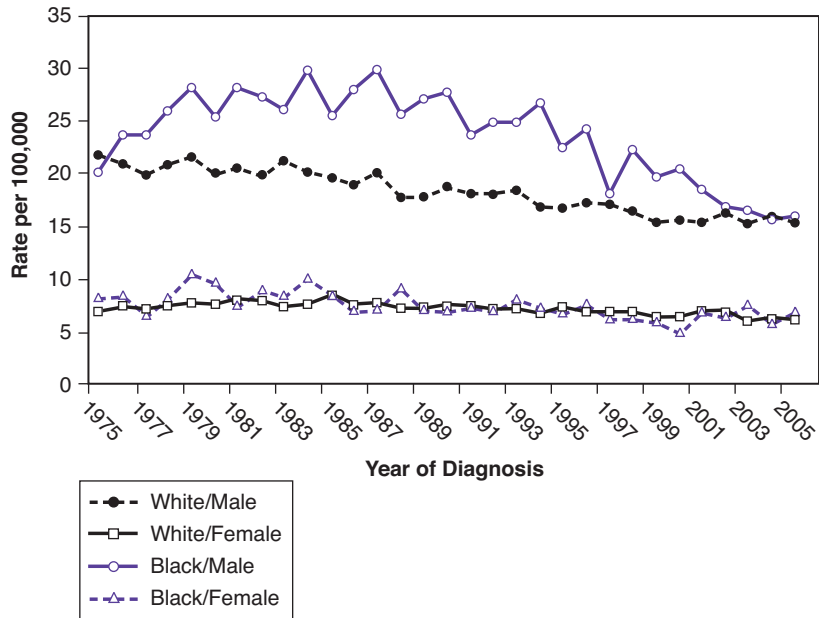


FIGURE 13-6 Trends in incidence of cancer of the oral cavity and pharynx. (From SEER Cancer Statistics Review, 1975–2005.)³⁰

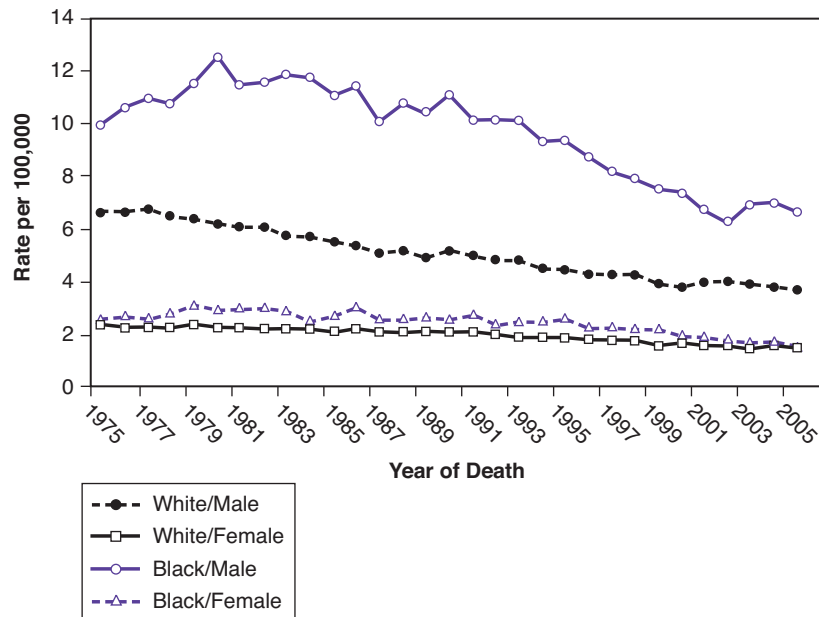


FIGURE 13-7 Trends in mortality from cancer of the oral cavity and pharynx: U.S. mortality age-adjusted rates, total United States (1975–2005). (From SEER Cancer Statistics Review, 1975–2005.)³⁰

vitamin D deficiency, and the iron deficiency of the Plummer–Vinson syndrome.³² Among viruses, Epstein–Barr virus and HPV have been linked with head and neck cancer. In addition, occupational exposure to chromium, nickel, radium, mustard gas, and by-products of leather tanning and woodworking has been associated with sinonasal cancers.³²

CLEFT LIP AND CLEFT PALATE

In 2005, approximately 3,233 babies were born with **cleft lip** and/or **cleft palate**, for a rate of 79.1 per 100,000 live births.³⁶ The cleft lip and/or palate rate was highest for non-Hispanic Whites followed by Hispanics and non-Hispanic Blacks. The rate for non-Hispanic Whites was more than twice the rate for non-Hispanic Blacks. The causes of cleft lip/palate are not well understood. Studies suggest that a number of genes, as well as environmental factors, such as drugs (including several different antiseizure drugs) and maternal smoking, may contribute. Other environmental factors that are suspected of playing a role include infections, maternal alcohol use and deficiency of the B vitamin folic acid.³⁷

Summary

During the past 50 years, significant improvements have been made in the oral health of U.S. citizens—for both children and adults. Caries rates have declined, the prevalence of gingivitis is lower, more adults are keeping their teeth longer, and mortality rates from oral cancer are becoming lower. Despite these improvements, certain segments of the population continue to experience oral health disparities. Low-income and minority children carry the burden of dental caries, low-income and minority adults are more likely to have untreated decay, and African American men have a higher incidence of oral and pharyngeal cancer. To see continued improvements in the oral health of Americans, efforts must be made to address and resolve the oral health disparities outlined in this chapter.

Learning Activities

1. The Centers for Disease Control and Prevention maintains a web site that tracks data related to the Healthy People 2010 objectives. Go to this web site and select the oral health focus area (<http://wonder.cdc.gov/data/2010/>). Compare the baseline data and target data for untreated decay in children ages 2 to 4, 6 to 8, and 15.
2. Look closely at Figures 13-6 and 13-7. Describe trends in oral cancer incidence and mortality rates over the past 30 years for Black males and White males.
3. Smoking is a significant risk factor for both periodontitis and oral cancer. For your next five adult patients who smoke, calculate the amount of time you talked with them about oral hygiene and smoking cessation. What did you spend more time talking about and why?

Review Questions

1. There has been a substantial decrease in the total amount of dental caries experienced by U.S. children ages 6 to 18 years; however, the amount of untreated decay has not changed.
 - a. True
 - b. False
2. Eighty percent of permanent teeth affected by caries can be found in what percentage of children ages 5 to 17 years?
 - a. 45%
 - b. 35%
 - c. 25%
 - d. 15%
 - e. 5%
3. About twice as many low-income children have untreated decay compared with high-income children.
 - a. True
 - b. False
4. Which of the following groups of adults tend to have higher levels of untreated coronal caries?
 - a. Males
 - b. Females

- c. Non-Hispanic Blacks
 - d. Mexican Americans
 - e. Non-Hispanic Whites
5. There has been a substantial decline in caries experience in all age groups in the United States.
 - a. True
 - b. False
 6. Which of the following describes trends in dental fluorosis?
 - a. The prevalence has decreased.
 - b. The prevalence has remained stable.
 - c. The majority of dental fluorosis cases can be classified as very mild.
 - d. The prevalence of fluorosis is lower in fluoridated communities compared with fluoride-deficient communities.
 - e. Most dental fluorosis cases can be classified as moderate.
 7. Which of the following groups has the highest prevalence and severity of gingivitis?
 - a. Preschool children
 - b. Elementary school children
 - c. Adolescents
 - d. Young adults
 - e. Older adults
 8. The prevalence of periodontal pocketing increases substantially with age.
 - a. True
 - b. False
 9. Which of the following groups of adults tend to have lower levels of periodontal disease?
 - a. Males
 - b. Females
 - c. Non-Hispanic Blacks
 - d. Mexican Americans
 - e. Non-Hispanic Whites

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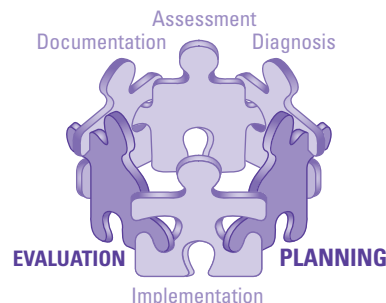
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Objectives

After studying this chapter and completing the study questions and activities, the learner will be able to:

- Explain the use of biostatistics in dental public health.
- Describe the purpose for data analysis.
- Describe the rationale for sampling methods.
- Select an appropriate statistical test to analyze a data set.
- Define common statistical terms.
- Compute central tendency measures from a data set.
- Use graphs and tables to describe data.
- Interpret the results of statistical tests.



KEY TERMS

Alternative hypothesis

Analysis of variance (ANOVA)

Bar chart

Bias

Cluster sampling

Confidence intervals

Confounding

Convenience sample

Correlation coefficient

Degrees of freedom

Dependent variables

Descriptive statistics

Frequency table

Histogram

Hypothesis testing

Independent variables

Inferential statistics

Interval variables

Linear regression

Logistic regression

Mean

Median

Mode

Nominal variables

Nonprobability samples

Normal distribution

Null hypothesis

Ordinal variables

p-value

Parameter

Percentiles

Power

Probability sampling

Quartile

Quota sample

Ratio variables

Sample

Simple random sampling

Standard deviation

Standard error

Statistical inference

Statistics

Stratified random sample

t-test

2 × 2 table

Type I error

Type II error

Variables

Variance

χ^2 (chi-square) test

See Appendix 3 for the ADEA competencies addressed in this chapter.¹

Introduction

Statistics is the science of making statements about an entire population from a limited sample of that population. It involves analyzing data and drawing conclusions, taking variation and uncertainty into account. Biostatistics is simply

the application of these methods in biologically relevant areas. The appropriate use and interpretation of biostatistical measures and tests are essential to every stage of a dental public health initiative. To define a problem in a community, you first must quantify it using descriptive statistics and measures of disease. As it often is



BOX 14-1 Example Study

The example study was a prospective cohort study to assess the effectiveness of a Spanish dental public health program after 7.5 years of follow-up. A 1985 report established the problem: 75% of Spanish schoolchildren between the ages of 6 and 12 were found to experience carious lesions. In 1987, a preventive program was established by the Ministry of Health. The program included health education, a weekly mouth rinse using sodium fluoride at 0.2% concentration, sealant placement on first permanent molars, and topical application of fluoride gel. To evaluate the effectiveness of the initiative in Móstoles, Spain, 547 children who had received the program and 237 children who had not received the preventive program were assessed. Dental examinations used World Health Organization criteria, using a mouth mirror, a sharp explorer, and natural light. Number of decayed, missing, or filled permanent teeth (DMFT) and number of decayed, missing, or filled permanent tooth surfaces (DMFS) were compared using the Mann–Whitney *U* test. A multivariate logistic regression was conducted to compare the odds of incident caries between the groups during the 7.5 years of follow-up, controlling for clinical and demographic variables. Significant differences between the groups were found in each case. The authors concluded that the preventive program had a protective effect.

From Tapias MA, DeMiguel G, Jimenez-Garcia R, et al. Incidence of caries in an infant population in Móstoles, Madrid. Evaluation of a preventive program after 7.5 years of follow-up. *Int J Paediatr Dent* 2001;11:440–446.²

impractical to evaluate the entire population, this requires that you take an appropriate **sample** of the population. You should be able to present your findings clearly, through the appropriate use of tables and graphs. During the planning (Chapter 6) and implementation of the initiative, you must have a sound understanding of data analysis, so that you will be sure to collect sufficient data to allow for program evaluation. For this reason, data analysis should always be planned prior to beginning your data collection. Finally, you should evaluate the success of your program (Chapter 7). As in the definition of the problem, descriptive statistics and biostatistical tests play a central role in this important stage of a dental public health intervention. Practically, this may mean that you consult with a biostatistician. It is always better to begin these consultations before collecting data, rather than after the fact because the way that you collect your data influences the analyses that are possible.

This chapter illustrates that epidemiology and biostatistics are intimately connected. A thorough description of concepts in epidemiology (Chapter 11) and their application (Chapter 12) serve as

important bases for understanding the information presented here. A referenced, published, dental public health cohort study will make abstract concepts more concrete. This study concerned the effectiveness of a dental health program in the town of Móstoles, Spain, to prevent dental caries in a population of schoolchildren.² A more complete description of the study may be found in Box 14-1. Further relevant details about this study will be discussed in the appropriate sections of this chapter.

SAMPLING FROM A POPULATION

In the example study, the authors did not assess every child in their population of interest (i.e., all 6-year-old Spanish schoolchildren followed from first grade). Instead, they examined a subset of this population, the 6-year-old, public and private, first grade schoolchildren of Móstoles, Spain, who were followed for 7.5 years. To be included in the study, both study and control children must have been examined in first and eighth grades, been born in 1982, and have provided parental informed consent. In statistical language,

this subset is called a sample. Usually, we wish to draw conclusions about some numeric aspect of the population. In statistical terms, a **parameter** is a numeric characteristic of the population. A parameter has a set value, but we usually do not know that value. A statistic is a numeric characteristic of the sample. We can know the value of a statistic in our sample, but the value will change from sample to sample. It is important that the sample be representative of the population of interest from which it was drawn because the statements (or inferences) about the whole population may be made from the measurements taken on the sample. If a sample is not representative of the population of interest, it is a biased sample. For example, in caries prevalence measures, schoolchildren living in a fluoridated community would be a biased sample of all children because, as a group, they would have a lower prevalence than the entire population of interest.

The best way to ensure a representative, unbiased sample is to perform **simple random sampling**. A simple random sample is one in which every item or person in the population has an equal and independent chance of being selected. A simple random sample is an example

of a probability sample. Probability samples are those drawn when you are able to identify and have access to all members of the population of interest. A **stratified random sample**, another type of probability sample, is a variant of the simple random sample. This sampling scheme is random sampling carried out in subgroups of a population to ensure that selections will be made from each level of the subgroup. For example, you may take steps to ensure that every age, sex, race, or social stratum subgroup is represented in sufficient numbers in the sample. This approach may be used for two reasons: (i) a simple random sample may allow an unrepresentative sample to be chosen because all possible combinations, including unrepresentative combinations, can occur in a simple random sample, or (ii) you want to have sufficient numbers of people in a given subgroup to analyze.

At times, a probability sample may not be possible or warranted. For example, you may not have access to the entire population of interest or variability may be low enough that the effort and cost of **probability sampling** outweighs the risk of drawing a biased sample. There are several subtypes of **nonprobability samples**.



BOX 14-2 Types of Samples

Probability Sample: A sampling from a population that you can identify and to which you have access to all members.

Simple Random Sample: Each item or person in the population of interest has an equal and independent chance of being selected.

Stratified Random Sample: Random sampling carried out in subgroups of a population to ensure that selections will be made from each level of the subgroup.

Nonprobability Sample: A sampling when you cannot identify or do not have access to the entire population of interest.

Cluster Sample: Drawing a simple random sample of small groups (clusters) of the population and assessing each subject in the sampled cluster.

Quota Sample: Sampling items or people in a block of predetermined size.

Convenience Sample: A sampling scheme in which the subjects are selected, partly or entirely, at the convenience of the researcher.

Cluster sampling divides the population into small groups (clusters), draws a simple random sample of clusters, and assesses every subject in the sampled clusters. This may be a good approach when cost and time to travel between randomly selected subjects would be prohibitive. A **quota sample** is drawn by selecting items or people in a block of predetermined size. For example, you may select the first ten women, without regard for the pool they may represent. Finally, a **convenience sample**, as its name suggests, is selected on the basis of convenience to the researcher, with little concern for representativeness. The types of samples are summarized in Box 14-2.

Applying this information to our example study, if the population of interest is Móstoles, then (not considering nonparticipation and loss to follow-up) we can think of the authors as having examined the entire population of interest, rather than a sample of the population. However, if all 6-year-old Spanish schoolchildren were the population of interest, which would be of broader interest, the children of Móstoles would represent a convenience sample of that population. In this case, one may argue that the effect of the preventive program in these children would not be representative of the effect in all Spanish schoolchildren.

DEFINITION AND COLLECTION OF DATA

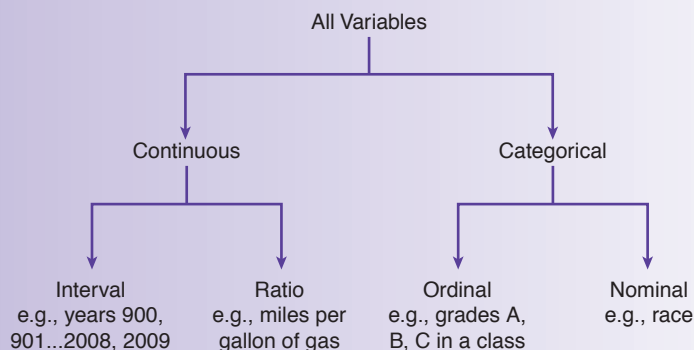
The population of interest is sampled for the purpose of making inferences from the data drawn. Raw data are organized into **variables**, anything that can be measured or manipulated in the study. Often, variables are described as being independent or dependent. **Dependent variables** essentially can be considered as the outcome variables, whereas the **independent variables** are the exposures. For example, in the example study, there were several dependent variables: DMFT, DMFS, and the presence or absence of carious lesions. The primary independent variable in the study was exposure to the preventive program.

Another way of classifying variables is by form as shown in Box 14-3. Understanding this classification is essential to selecting the appropriate statistical test to analyze data. Broadly, variables can be classified into categorical and continuous variables.

Categorical variables can be further divided into **nominal** and **ordinal variables**. In a nominal scale, discrete categories do not have a quantitative relationship with each other. A nominal scale, for example, records eye color as blue/ green/brown/hazel or answers to a question as yes/no. As implied, ordinal variables consist of ordered categories; however, the difference



BOX 14-3 Classification of Variables



between the categories is not specified. The use of A, B, and C letter grades is an example of an ordinal scale. Unless specific numeric quantities are assigned, the difference between a C and a B is not necessarily the same as the difference between a B and an A.

Continuous variables represent measured quantities (e.g., blood pressure and temperature). Continuous variables may be divided into **interval** and **ratio variables**. The points on an interval scale are equally spaced, and the difference between two points is meaningful (e.g., the difference between 30 and 31°C is the same as 89 and 90°C). However, 100°C is not twice as hot as 50°C. As you may guess, the ratio between points on a ratio scale has meaning. Age is an example of a ratio scale. Therefore, David, who is 18, is twice as old as his brother Michael, who is 9. It should be noted that continuous variables, whether interval or ratio, are analyzed in the same way.

Returning to our example study, you now can see that the DMFT and DMFS outcomes are continuous, interval-scale variables, whereas presence or absence of carious lesions is a nominal categorical variable.

FREQUENCY TABLES AND DESCRIPTIVE STATISTICS

There are two steps in data analysis. The first is to calculate **descriptive statistics**, the characteristics of the data found within the sample of individuals in whom the study was conducted. The second step is to calculate **inferential statistics**. The purpose of generating inferential statistics is to determine whether the results found in the sample may be a result of chance or, assuming no other threats to validity, whether we can generalize our results to the general population of interest. First, we will consider descriptive statistics and then move on to inferential statistics.

Frequency Tables

A study yields raw data that are organized into variables, which are distributed in some way among the various categories (categorical variables) or across the various possible values

(continuous variables). Visual and mathematical summarization enhances the communication of the distribution. There are several techniques for displaying data. Here, we will discuss the **frequency table**, relative frequency table, **histogram**, and **bar chart**.

The investigators in our example study in Box 14-1 measured DMFT for each child in the sample. For the purposes of illustration, suppose that a subset of the results were as follows:

0	2	3	1	0
0	9	4	1	4
1	2	2	8	0
0	5	5	1	1
6	0	1	0	2
2	0	7	4	4

The first step you may take would be to organize the data in ascending order:

0	0	0	0	0
0	0	0	1	1
1	1	1	1	2
2	2	2	2	3
4	4	4	4	5
5	6	7	8	9

One way of summarizing the measurements is a frequency table, shown in Table 14-1. To create the table, appropriate intervals were chosen for DMFT, and a number was computed for measurements falling within each interval. In this case, the intervals are of equal width, which, although not strictly necessary, is often desirable. The width of each class interval determines the

TABLE 14-1 HYPOTHETICAL FREQUENCY TABLE OF DMFT IN SPANISH SCHOOLCHILDREN AT AGE 13

DMFT	FREQUENCY*
0–1	14
2–3	6
4–5	6
6–7	2
8–9	2

* Frequency is the number of subjects with the corresponding DMFT range.

number of intervals and, thus, the level of detail with which the data will be reported. As a rule of thumb, about 5 to 10 intervals are appropriate for most purposes. With fewer intervals, too much information may be lost. A greater number of intervals may give too much detail, losing the ability to obtain an overall feel for the distribution. In some cases, you may select intervals on the basis of precedence—if other investigators have reported findings with certain intervals, using the same intervals would facilitate comparison. Of course, in the case of categorical variables, the information is already organized into categories, although you may choose to combine two or more levels of a category. For example, if information was collected about a subject's smoking history as “never smoker/past smoker,” “quit ≥ 2 years ago/past smoker,” “quit < 2 years ago/current smoker,” depending on the aim of your analysis, you may decide to combine the two “past smoker” categories, leaving “never smoker/past smoker/current smoker.”

By dividing actual frequency by the total number of observations and, subsequently, multiplying by 100, the percentage of subjects in each interval can be obtained. By doing so, you have calculated a relative frequency distribution. As a math check, the relative frequencies should total approximately 100%, allowing for some small error due to rounding. The relative frequency distribution for the frequency table presented as Table 14-1, “Hypothetical Relative Frequency Table of DMFT in Spanish Schoolchildren at Age 13,” is shown in Table 14-2.

TABLE 14-2 HYPOTHETICAL RELATIVE FREQUENCY TABLE OF DMFT IN SPANISH SCHOOLCHILDREN AT AGE 13

DMFT	FREQUENCY	RELATIVE FREQUENCY (%)
0–1	14	46.67
2–3	6	20.00
4–5	6	20.00
6–7	2	6.67
8–9	2	6.67
Total	30	100.01

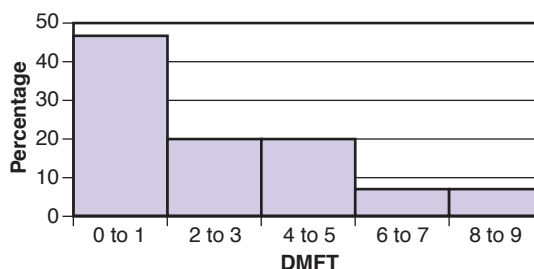


FIGURE 14-1 Histogram—DMFT in Spanish schoolchildren.

A histogram or bar chart can be constructed from a relative frequency distribution. Histograms are used for continuous variables, and bar charts are used for categorical variables. A bar should be drawn for each interval or category; the height of the bar is determined by the relative frequency of occurrence of measurements in that interval. The data from Table 14-2 are represented in Figure 14-1. Assuming that every interval of the continuous variable has at least one subject, there are no spaces between the bars of a histogram.

In a bar chart, the bars are of equal width and may be vertical or horizontal. There are spaces between the bars representing each category. In the example study, the investigators assessed the social class of the study subjects at the beginning of the study. To assess whether exposure to the caries prevention programs described in Box 14-1 varied by social class, the authors may have presented a bar chart, such as shown in Figure 14-2.

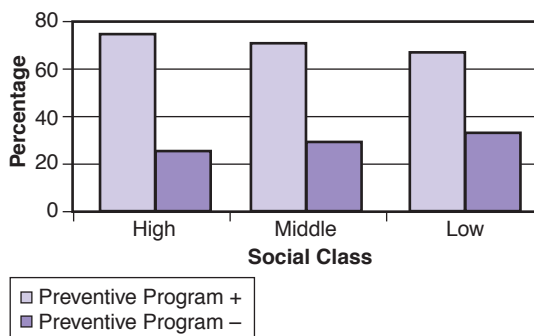


FIGURE 14-2 Bar chart—exposure to preventive program by social class.

Despite similarities, do not confuse histograms and bar charts. Histograms need to be constructed more precisely because the area of the bar (height $\times$ width) represents the frequency distribution of the data. If the intervals are equally spaced, the bars are of equal width; however, you must be more careful when using unequally spaced intervals, for example, if you are presenting a bar chart in which the DMFT intervals are 0 to 1, 2 to 3, and 4 or more. As previously mentioned, there are no spaces between the bars of a histogram.

Descriptive Statistics

Although frequency distributions are convenient ways to summarize data, they do have disadvantages. For example, it would be easier to compare a single summary value than to try to compare distributions from two different samples. As a result, we rely on mathematical approaches to summarize the data through two types of descriptive statistics: (i) measures of central tendency, and (ii) measures of spread.

MEASURES OF CENTRAL TENDENCY

Measures of central tendency attempt to identify the middle of a distribution to provide one sample statistic that describes the character of an entire data set. Three measures of central tendency—the **mode**, the **median**, and the **mean**—are introduced here. The sample mean of a data set is the arithmetic average, which is the sum of observations divided by the number of observations. For example, if you measured decayed, missing, or filled primary tooth surfaces (dmfs) among five first grade schoolchildren and obtained the following data: 0, 3, 1, 2, and 4, the mean, or average, dmfs would be $(0 + 3 + 1 + 2 + 4)/5 = 2.0$. By substituting symbols for these numbers, we can represent the general formula for the mean. Each symbol, $x_1, x_2, x_3, \dots$, etc., to x_n , represents an individual observation, where n is the total number of observations. The mean of the sample is represented by the symbol $\bar{x}$ (x -bar). Thus, the formula for the mean would be:

$$\bar{x} = \frac{x_1 + x_2 + \dots + x_n}{n}$$

Median is a second measure of central tendency. The median of a sample is the middle item of a data set, which will divide a data set arranged in order in half. To find the median, the data must first be arranged in order of increasing value. Continuing the example from the previous paragraph, this results in 0, 1, 2, 3, and 4. In this case, the median is 2. This example was straightforward because there were an odd number of observations, with a single observation in the middle to serve as the median. If there is an even number of observations, then the median is the mean of the middle pair of observations. To illustrate, if you had collected dmfs data on one additional child, you would have the following observations: 0, 1, 2, 3, 3, and 4. The middle pair of observations is formed by 2 and 3, and the mean of this pair is $(2 + 3)/2 = 2.5$. Thus, the median in this case is 2.5. Note that three observations fall below 2.5 and three observations fall above 2.5. Because it would be very difficult to visually judge the location of the middle point in a large data set, out of n ordered observations, the $((n + 1)/2)$ th observation is the median. Using this technique to identify the median in an odd number of observations is straightforward, so we will illustrate this technique on the data set with an even number of observations: 0, 1, 2, 3, 3, and 15. There are six observations, so the $(6 + 1)/2 = 3.5$ th observation should be the median. The 3.5th observation is midway between 2 and 3, or 2.5, agreeing with what was concluded previously.

The final measure of central tendency to be considered is the mode, which is the most frequently occurring value in a set of observations. Again, it is convenient to arrange the observations in increasing order to judge how often a value occurs. For example, the mode of the 0, 1, 2, 3, 3, 4 data set is 3 because this value occurs twice and all other values occur only once. If our data set were 0, 1, 1, 2, 3, 3, 4, there would be two modes, 1 and 3, and this data set would be called bimodal. When all values occur with the same frequency, the data set is said to have no mode.

The definitions of the measures of central tendency are located in Box 14-4 to assist in review. We will now discuss their use. The chief advantage of mode is that it is the only measure of central



BOX 14-4 Definition of Measures of Central Tendency

Mean: The mean of a set of n observations is the arithmetic average, which is the sum of the observations divided by the number of observations.

Median: The median is the midpoint of a set of observations when they are arranged in increasing order.

Mode: The mode is the most frequent value in a set of observations.

tendency that makes sense for nominal categorical variables, such as eye color. It would not make sense to place eye color in ascending order to identify the median, nor would it make sense to identify the average eye color. It would, however, be perfectly sensible to say that the most frequent eye color in a given sample is brown. Otherwise, mode is not often used, as it records only the most frequent value, which may be far from the center of the distribution of values. Median is based only on the order of information in the data (i.e., how many observations are above and below a given point). Therefore, median is useful for describing the central tendency of ordinal categorical variables, as well as continuous variables. Median is not influenced by and does not convey the actual numeric values of the observations. In some cases (e.g., when a single observation has an unusually high or low value), this may be advantageous because this observation will not influence the median. This can be illustrated using the example used in this section. The observations of dmfs were 0, 1, 2, 3, 3, and 4, with a mean of 2.16 and a median of 2.5. Suppose, however, that instead of a dmfs of 4, the child with the highest dmfs had 15 dmfs. Clearly, this child had an unusually high dmfs. The mean dmfs in this sample would be 4.2, whereas the median would remain 2.5. Despite this, because the additional information about numeric values of the observations is use-

ful in most cases, the mean is the most commonly used measure of central tendency. The mean only makes sense in the context of continuous variables; however, in practice, the mean is also frequently calculated for ordinal variables with many levels, for example, age in years.

The relationship between mean, median, and mode may be graphically appreciated through the frequency curve of a distribution. The frequency curve is simply a smooth version of the histogram, which was described in a previous section of this chapter. The mode is the highest point of the curve; the median is the value that divides the area under the curve in half. The location of the mean is slightly more difficult to conceptualize. If you think of the curve as a solid object, the mean would be the point at which the shape would balance. The mean, median, and mode coincide on a symmetrical frequency curve. If, however, the distribution is skewed, the mean is drawn toward the long tail of the distribution, again demonstrating how sensitive the mean is to extreme values. These points are illustrated in Box 14-5.

MEASURES OF SPREAD

By itself, a measure of center is an incomplete descriptor of data because it says nothing about the variability among the data. For example, knowing that the median real income of U.S. households in 2007 was \$50,233.00 does not reveal that 20% of households earned less than \$19,178 or that 1.93% of households earned more than \$250,000.³ To provide a more complete description, the second category of descriptive statistics—measures of spread—is required. The measures of spread presented depend on the measure of central tendency.

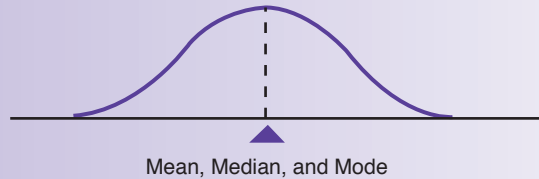
When the median is the measure of central tendency, both the variability and the shape of a distribution can be described by giving several **percentiles** and the extreme values of a data set. The x th percentile of a distribution of numbers is a value in which “ x ” percent of numbers fall below it and the remainder fall above it. You may have encountered percentiles in reviewing the results of standardized tests, such as the standard achievement tests. For example, your score may



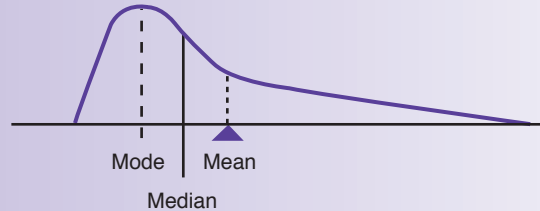
BOX 14-5 Graphical Relationships Between Mean, Median, and Mode

The mode is located at the highest point of the frequency distribution, whereas the median is the point that divides the area under the curve into two equal parts, to the left and the right. The mean is the point at which the curve would balance on a pivot placed beneath the curve.

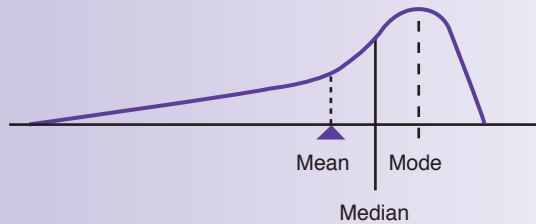
In a symmetric distribution, the mean, median, and mode coincide:



In a skewed distribution, the mean is located farther toward the long tail than is the median. Positive (toward the right) Skew:



Negative (toward the left) Skew:



have been reported as "Raw score, 640; percentile, 88," meaning that you scored 640 and that 88% of those taking the exam had scores lower than yours. Certain percentiles are used so often for describing data that they have specific names: the 50th percentile is the median; the lower **quartile** is the 25th percentile, and the upper quartile is the 75th percentile. To completely describe a data set when presenting the median as the measure of central tendency, you should report four other values: the lower quartile, the upper quartile, and the two extremes (the small-

est and largest individual observations). Each measure fulfills some function in describing the data. The extremes convey the overall spread of the data, but they clearly are sensitive to outliers. The upper quartile, lower quartile, and median divide the data into quarters. The area bound by the upper and lower quartiles shows the spread of the middle of the data, and the distance of the upper and lower quartiles from the median gives an indication of the symmetry of distribution. With symmetric distribution, the upper and lower quartiles will be equidistant from the median.

To illustrate this, suppose that we conducted a survey of 30 dental hygienists regarding their yearly income, with the obtained results listed below:

\$40,017	\$40,028	\$40,780	\$41,889	\$42,345
\$43,222	\$43,947	\$45,816	\$46,989	\$47,734
\$48,478	\$48,725	\$49,431	\$50,567	\$50,941
\$51,789	\$52,199	\$54,157	\$54,275	\$55,000
\$55,601	\$56,050	\$56,872	\$57,378	\$58,722
\$58,999	\$59,756	\$60,102	\$61,341	\$64,073

The results have been arranged in ascending order to simplify the identification of the percentiles. As there are 30 results, the median should be the mean of the 15th and the 16th values, or \$51,365. To find the lower quartile, compute the median of all observations falling below the location of the overall median. Because there are 15 incomes below \$51,365, the 8th value should be the median. Thus, the lower quartile is demarcated by \$45,816. To find the upper quartile, compute the median of all observations falling above the location of the overall median.



BOX 14-6 Illustration of Variance and Standard Deviation

You want to find the variance and SD of the five observations: 2, 7, 5, 3, and 10. To do so, you would follow four steps.

1. Compute the mean of the observations:

$$\bar{x} = \frac{2 + 7 + 5 + 3 + 10}{5} = \frac{27}{5} = 5.4$$

2. Determine the squared difference (deviation) between each observation x and the mean.

Observation x	Deviation $x - \bar{x}$	Squared Deviation $(x - \bar{x})^2$
2	$2 - 5.4 = -3.4$	$(-3.4)^2 = 11.56$
3	$3 - 5.4 = -2.4$	$(-2.4)^2 = 5.76$
5	$5 - 5.4 = -0.4$	$(-0.4)^2 = 0.16$
7	$7 - 5.4 = 1.6$	$(1.6)^2 = 2.56$
10	$10 - 5.4 = 4.6$	$(4.6)^2 = 21.16$
Total:	0	41.20

3. Calculate the variance by determining the mean squared deviation:

$$\text{variance} = \frac{\text{sum of squared deviations}}{\text{number of observations}} = \frac{41.20}{5} = 8.24$$

4. Determine the SD by taking the square root of the variance:

$$\text{SD} = \sqrt{\text{variance}} = \sqrt{8.24} = 2.87$$

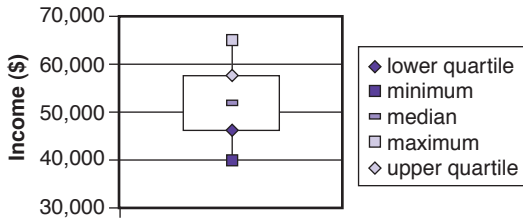


FIGURE 14-3 Box plot—income levels of dental hygienists.

In this case, it is \$56,872. The smallest individual observation is \$40,017, whereas the largest individual observation is \$64,073. Graphically, we can represent these values in a box plot, as illustrated in Figure 14-3. The ends of the central box are marked by the quartiles, and the median of the distribution is marked by the line within the box. The “whiskers” at either end extend to the extremes.

When using the mean as a measure of central tendency, the measure of spread presented is either the **standard deviation** (SD) or the **variance**. The SD is sometimes abbreviated as s , and the variance sometimes is abbreviated as s^2 . The SD is simply the square root of the variance. To calculate variance, you first must determine the mean of the observations. The next step is to determine the deviation of each observation from the mean (difference between each observation and the mean); for each observation, you then square this deviation. Finally, you find the mean squared deviation. This is the variance. These points are illustrated in Box 14-6. You can interpret the SD as a type of average deviation of the observations from their mean. If the observations are close together, the SD is small. In the extreme case, in which all observations have the same value, the SD will be zero. As the observations become more spread out, the SD increases. Like the mean, the SD may be strongly influenced by unusually high or low values (outliers). Finally, the SD is not useful in describing strongly skewed distributions. Because the two sides of a skewed distribution have different spreads, the SD, being a single number, cannot adequately describe the spread. In these cases, the previously described median, quartiles, and extremes would serve as better descriptors.

THE STANDARD NORMAL DISTRIBUTION

The previous section discussed frequency distributions. This section pays special attention to a particular type of frequency distribution: the standard **normal distribution**, which is a normal distribution with mean = 0 and SD = 1. It is customary to use the capital letter Z to designate the variable associated with this distribution and to use a small letter z to denote a particular value taken by Z . Do not let the abstract terminology confuse you: this just means that, if, for instance, the temperature in Siberia followed a standard normal distribution, we would call temperature Z . Then, any given temperature, like 1°C , would be called z . If you wanted to find out the probability of the temperature having the value of 1°C or lower, you would consult a table of the areas under the standard normal curve. One such table is shown as Table 14-3, which gives the area to the left of a point on the x -axis for many potential values of z . The area under the curve tells you the probability of $Z \leq z$, for example, temperature $\leq 1^\circ\text{C}$.

Consult Table 14-3 to determine the probability that Z will take on a value of 1.0 or less. You should have obtained a 0.8413, or 84.13%. Figure 14-4 illustrates this probability on the standard normal curve. The probability gives both the likelihood that a single random drawing from a population has the specified property (such as $z \leq 1.0$), as well as the proportion of the entire population that has that property. In other words, in a standard normal population, 84.13% of the members of the population have z measurements of ≤ 1.0 .

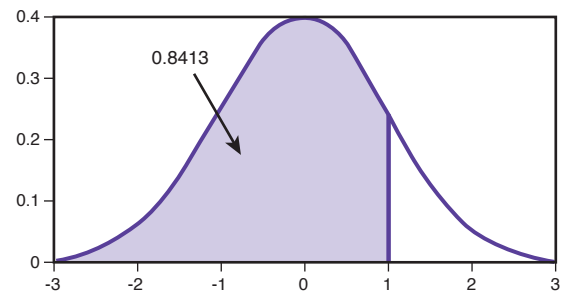


FIGURE 14-4 Determining the probability of $Z \leq 1$ from the standard normal curve.

TABLE 14-3 STANDARD NORMAL DISTRIBUTION

z	$p(Z < z)$	z	$p(Z < z)$	z	$p(Z < z)$	z	$p(Z < z)$
0.0000	0.5000	0.8416	0.8000	1.6000	0.9452	2.4000	0.9918
0.1000	0.5398	0.9000	0.8159	1.6450	0.9500	2.5000	0.9938
0.1257	0.5500	1.0000	0.8413	1.7000	0.9554	2.5760	0.9950
0.2000	0.5793	1.0364	0.8500	1.7510	0.9600	2.6000	0.9953
0.2533	0.6000	1.1000	0.8643	1.8000	0.9641	2.7000	0.9965
0.3000	0.6179	1.2000	0.8849	1.8810	0.9700	2.8000	0.9974
0.3853	0.6500	1.2816	0.9000	1.9000	0.9713	2.9000	0.9981
0.4000	0.6554	1.3000	0.9032	1.9600	0.9750	3.0000	0.9987
0.5000	0.6915	1.3410	0.9100	2.0000	0.9773	3.0900	0.9990
0.5244	0.7000	1.4000	0.9192	2.0540	0.9800	3.2000	0.9993
0.6000	0.7257	1.4050	0.9200	2.1000	0.9821	3.2910	0.9995
0.6745	0.7500	1.4760	0.9300	2.2000	0.9861	3.4000	0.9997
0.7000	0.7580	1.5000	0.9332	2.3000	0.9893	3.6000	0.9998
0.8000	0.7881	1.5550	0.9400	2.3260	0.9900	3.7190	0.9999

For negative values of z , $p(Z \leq -z) = 1 - p(Z \leq z)$. For example, $p(Z < -0.5) = [1 - (p(Z \leq 0.5))] = 1 - 0.6915 = 0.3085$.

Apart from the standard normal distribution, there are many possible normal distributions with mean $\neq 0$ and SD $\neq 1$. All of them have a symmetrical bell shape with mean = median = mode. Furthermore, all normal distributions share these characteristics: (i) 68% of the observations lie within one SD from the mean; (ii) another 27% of the observations fall between one and two SDs from the mean; and (iii) in all, 99.7% of the observations fall within three SDs from the mean (Figure 14-5).

Suppose that age of eruption of first permanent molars is normally distributed with a mean = 6 and SD = 1.5. Given this information, you would know that 95% of first molars erupt within $6.0 \pm (2 \times 1.5)$ years. Thus, 95% of first permanent molars would erupt between $6.0 - 3.0 = 3.0$ and $6.0 + 3.0 = 9.0$ years.

What if you wanted to know more than that, though? What if you were treating an 8.7-year-old child whose first permanent molars had not erupted. You want to know the probability of his first permanent molars erupting by this age

to know whether you should be concerned. It would be simple to figure this out if you had a table similar to Table 14-3, but there are just too many normal distributions to have a table for each of them. Fortunately, there is a way to transform a nonstandard normally distributed

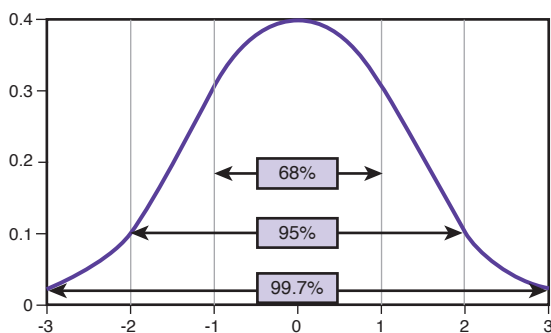


FIGURE 14-5 Properties of normal distribution. In a normal distribution, 68% of the data lies within one standard deviation of the mean, 95% falls within 2 SD of the mean, and 99.7% falls within 3 SD of the mean. In the standard normal distribution with mean = 0 and SD = 1, the data would be distributed as shown here.

variable X , like age at first permanent molar eruption, into a standard normally distributed Z . The transformation formula is $z = \frac{x - \bar{x}}{s}$, where x is the value of the variable that follows the non-standard normal distribution, $\bar{x}$ is the estimated mean of this distribution, and s is the estimated SD of the distribution. Once you have transformed it, you will be able to use Table 14-3 to answer your question.

So, to determine the probability that the first permanent molars erupt by age 8, you simply substitute in the appropriate numbers in the formula (recalling that the mean age of eruption = 6.0, with a SD = 1.5): $z = \frac{8.7 - 6}{1.5} = 1.80$.

Consulting Table 14-3, you can see that the probability of $z \leq 1.8 = 0.9641$. Thus, the probability that an 8.7-year-old child would not have erupted first permanent molars is $1 - 0.9641 = 0.0359$, or, 3.59%. Based on this information, it does seem that your concern for the child is justified.

ASSESSING RELATIONSHIPS BETWEEN TWO VARIABLES

Our example study, summarized in Box 14-1, found that schoolchildren who were “exposed” to a preventive program had a lower DMFT than those who were not exposed to this program. The purpose of many studies is to identify the relationship between two variables in a data set, and from this, to make inference about the relationship between these two variables in a more general population. Here, we will discuss how to describe the relationships, and in the next section, we will move on to statistical inference.

The first goal in exploring the relationship between two variables is to describe the relationship. When both variables are categorical, a frequency table is used to describe the association between them. If both categorical variables have only two levels (binary variables), we can further calculate a risk ratio or an odds ratio, as appropriate, to summarize the relationship. When both variables are continuous, we can

convey the relationship in a type of graph, often called a scatter diagram. We can then determine the presence, strength, and direction of any straight-line pattern to the relationship using the **correlation coefficient**. If the outcome is continuous and the exposure is categorical, we can report measures of central tendency and spread of the continuous outcome variable for each level of the categorical exposure variable. Each of these concepts will be discussed in the following sections.

Cross-Tabulated Data

One outcome examined in the example study described in Box 14-1 was the prevalence of carious lesions in the permanent dentition in those exposed and not exposed, respectively, to a dental preventive program. The two variables being considered here are presence of carious lesions and exposure status. The findings can be depicted in a 2×2 (two-by-two) **table**, as shown in Table 14-4.

Because 2×2 tables are commonly used, you should have a good understanding of the information they contain. Table 14-4 shows that 547 subjects were exposed and 237 subjects were not exposed to the program. Additionally, 458 had carious lesions in their permanent teeth, whereas 326 did not. Finally, we can see how many of the exposed and nonexposed had carious lesions in their permanent teeth. By using this information to calculate the percentage of the exposed and the nonexposed, respectively, who had carious

TABLE 14-4 CROSS-TABULATION OF EXPOSURE TO PREVENTIVE PROGRAM AND PRESENCE OF CARIOUS LESIONS IN THE PERMANENT TEETH

	CARIOUS LESIONS IN PERMANENT TEETH	NO CARIOUS LESIONS IN PERMANENT TEETH	TOTAL
Exposed	289	258	547
Not Exposed	169	68	237
Total	458	326	

lesions in the permanent teeth, we can begin to describe the relationship between the preventive dental program and the presence of carious lesions. 52.8% (289/547) of those who received the program had carious lesions in their permanent teeth, whereas 71.3% (169/237) of those who did not receive the program had carious lesions in their permanent teeth. Restated, the risk for carious lesions in the permanent teeth is 52.8% in the exposed and 71.3% in the nonexposed—a larger percentage of the nonexposed than the exposed had carious lesions in their permanent teeth. Because both the exposure and the outcome variables are binary, we can summarize the relationship in a single number—the risk ratio. To calculate risk ratio, you simply take the risk in the exposed and divide it by the risk in the nonexposed. In our example, it is 52.8%/71.3%, which is 0.74, indicating that the exposed are 26% less likely to have carious lesions than the nonexposed. The risk ratio always has a positive value, which can range from 0 to infinity. A risk ratio of 1 indicates that there is no relationship between exposure and outcome. This is easier to understand through an example. Suppose that the exposed and the nonexposed cohorts had the same risk for having permanent carious lesions and that this risk was 60%. The risk ratio would then be 60%/60%, which is 1. A risk ratio below 1 indicates that the exposed group is at lower risk for the outcome than the nonexposed group, whereas a risk ratio above 1 indicates that the exposed group is at higher risk for the outcome than the nonexposed group.

Here, we examined results from a cohort study. From data collected through cohort studies or experimental studies, you can calculate a risk ratio. You cannot calculate a risk ratio from data collected through a case-control study, but you can calculate the odds ratio, which is an approximation to the risk ratio. The reasoning behind the inability to directly calculate the risk ratio from case-control studies is beyond the scope of this chapter. For further information, you may consult the excellent book, *Modern Epidemiology*.⁴

The general formulae for the risk ratio and the odds ratio may be found in Box 14-7. Suppose we conduct a retrospective case-control study

TABLE 14-5 CROSS-TABULATION OF HEAVY ALCOHOL INTAKE AND PRESENCE OF ORAL CANCER

		ORAL CANCER		
		+	–	
Heavy Alcohol Intake	+	18	13	31
	–	82	87	169
Total		100	100	200

to examine the relationship between oral cancer and a history of heavy alcohol intake. This means that we identified people from the same population with (case) and without (control) oral cancer and determined their alcohol intake history. Suppose that this yielded the 2×2 table shown as Table 14-5.

The odds of exposure to heavy alcohol intake among the cases is:

$$\frac{a/(a + c)}{c/(a + c)} = \frac{a}{c} = 0.22,$$

which means that the cases are 0.22 times as likely to be exposed than they are to be non-exposed.

The odds of exposure to heavy alcohol intake among the controls is:

$$\frac{b/(b + d)}{d/(b + d)} = \frac{b}{d} = 0.15$$

which means that the controls are 0.15 times as likely to be exposed than they are to be non-exposed.

The odds ratio, then, is:

$$\frac{a/c}{b/d} = \frac{0.22}{0.15} = 1.47$$

This answer is nearly the same as by using the $(a \times c)/(b \times d)$ formula shown in Box 14-7. They differ slightly because of a rounding error. Interpreting this as an approximation to the risk ratio, it can be concluded that those exposed to heavy alcohol intake are 47% more likely to develop oral cancer than those not exposed to heavy alcohol intake.



BOX 14-7 Risk Ratio and Odds Ratio

	Outcome +	Outcome –
Exposed	a	b
Nonexposed	c	d

1. Calculation of the risk ratio:

a. Risk in the exposed = $\frac{a}{a + b}$

b. Risk in the nonexposed = $\frac{c}{c + d}$

c. Risk Ratio = $\frac{a/(a + b)}{c/(c + d)}$

2. Calculation of the odds ratio:

a. Odds of exposure among outcome = $\frac{a/(a + c)}{c/(a + c)}$

b. Odds of exposure among outcome = $\frac{b/(b + d)}{d/(b + d)}$

c. Odds Ratio = $\frac{\left(\frac{a/(a + c)}{c/(a + c)} \right)}{\left(\frac{b/(b + d)}{d/(b + d)} \right)} = \frac{\frac{a}{c}}{\frac{b}{d}} = \frac{a \times d}{b \times c}$

Scatter Diagrams and Correlation

When the exposure and the outcome variables are continuous or ordinal, a scatter diagram can be used to visually depict the relationship and a correlation coefficient can be calculated to numerically describe the relationship. Exposure and outcome are positively associated when larger values of one tend to be associated with larger values of the other (e.g., height and weight are positively associated because taller people tend to weigh more). However, an exposure and an outcome are negatively associated when larger values of one tend to be associated with smaller

values of the other (e.g., you may suppose that DMFT would decrease with increasing income).

This hypothetical relationship between DMFT and income can be visually conveyed through a scatter diagram. In a scatter diagram, the exposure units are marked on the x -axis (horizontal), and the outcome units are marked on the y -axis (vertical). Each observation is represented by a point with a horizontal coordinate equal to the value of the exposure and a vertical coordinate equal to the value of the outcome. Therefore, for a person with an annual income of \$40,000 and a DMFT of 3, the point shown in

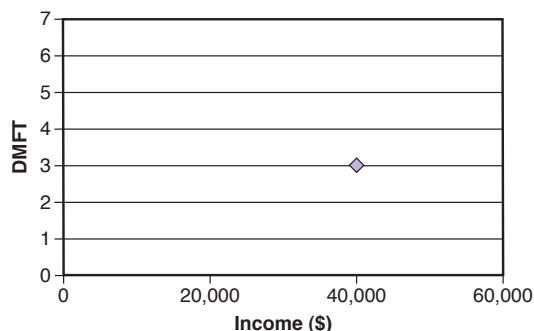


FIGURE 14-6 Plotting the point (income = \$40,000; DMFT = 3) in a scatter diagram.

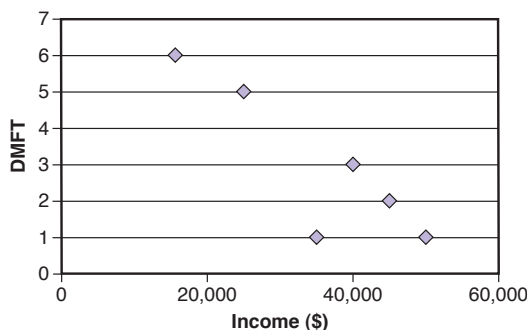


FIGURE 14-7 Scatter diagram of income versus DMFT

Figure 14-6 would be plotted. Continuing this procedure for each observation, you may end up with a similar scatter diagram as the one shown in Figure 14-7. Through the scatter diagram, you can appreciate the relationship between continuous exposure and outcome, and you can identify individual observations that deviate from

the overall relationship. These observations are called outliers. Figure 14-7 shows that the person with an annual income of about \$35,000 had an unusually low DMFT of 1.

A correlation coefficient (r) numerically describes the relationship between continuous exposure and continuous outcome. It should not



BOX 14-8 Formula for and Interpretation of the Pearson Correlation Coefficient

For each of the n subjects you ascertained, you gathered information on exposure (x ; e.g., income) and outcome (y ; e.g., DMFT). Therefore, for the first subject, you collected observation x_1, y_1 ; for the second subject, you collected observation x_2, y_2 ; and for the n th subject, you collected observation x_n, y_n . To compute the correlation coefficient, follow these steps:

1. Find the mean $\bar{x}$ and SD s_x of the values $x_1, x_2, \dots, x_n$ of the exposure variable.
2. Find the mean $\bar{y}$ and SD s_y of the values $y_1, y_2, \dots, y_n$ of the outcome variable.
3. Enter the terms into the following formula for the correlation coefficient r :

$$r = \frac{\frac{1}{(n-1)} [(x_1 - \bar{x})(y_1 - \bar{y}) + (x_2 - \bar{x})(y_2 - \bar{y}) + \dots + (x_n - \bar{x})(y_n - \bar{y})]}{s_x s_y}$$

4. Interpret the r according to the following criteria;

$ r = 1$	Perfect correlation
$ r \geq 0.7$	Strong correlation
$0.3 \leq r < 0.7$	Moderate correlation
$ r < 0.3$	Weak correlation

be calculated for ordinal variables; however, in practice, it often is. The calculation of the correlation coefficient is algebraically intensive, and in practice, this and most other statistical calculations are done with a computer or statistical calculator. Nevertheless, the formula for the Pearson correlation coefficient is included in Box 14-8, so you can see how it is calculated.

The following points help to understand and properly interpret the correlation coefficient:

1. The correlation coefficient has a range from -1 to $+1$. It is positive when the association is positive (as the value of the exposure variable increases, the value of the outcome variable increases), and it is negative when the association is negative (as the value of the exposure variable increases, the value of the outcome variable decreases).
2. The correlation coefficient measures how tightly the points on the scatter diagram cluster around a straight line. The extreme values of the correlation coefficient, -1 and $+1$, indicate that all points fall perfectly on a straight line. If $r = -1$, the straight line would have a negative slope; if $r = +1$, the straight line would have a positive slope. As a rule of thumb, there is a strong linear association if the absolute value of r , $|r| \geq 0.7$; there is a moderate linear association if $0.3 \leq |r| < 0.7$; and there is a weak linear association if $|r| < 0.3$. Weak, moderate, and strong correlations between height (inches) and weight (pounds) are illustrated in Figure 14-8.
3. To understand how the correlation coefficient is strongly influenced by outliers, consider the relationship shown in Figure 14-7. Based

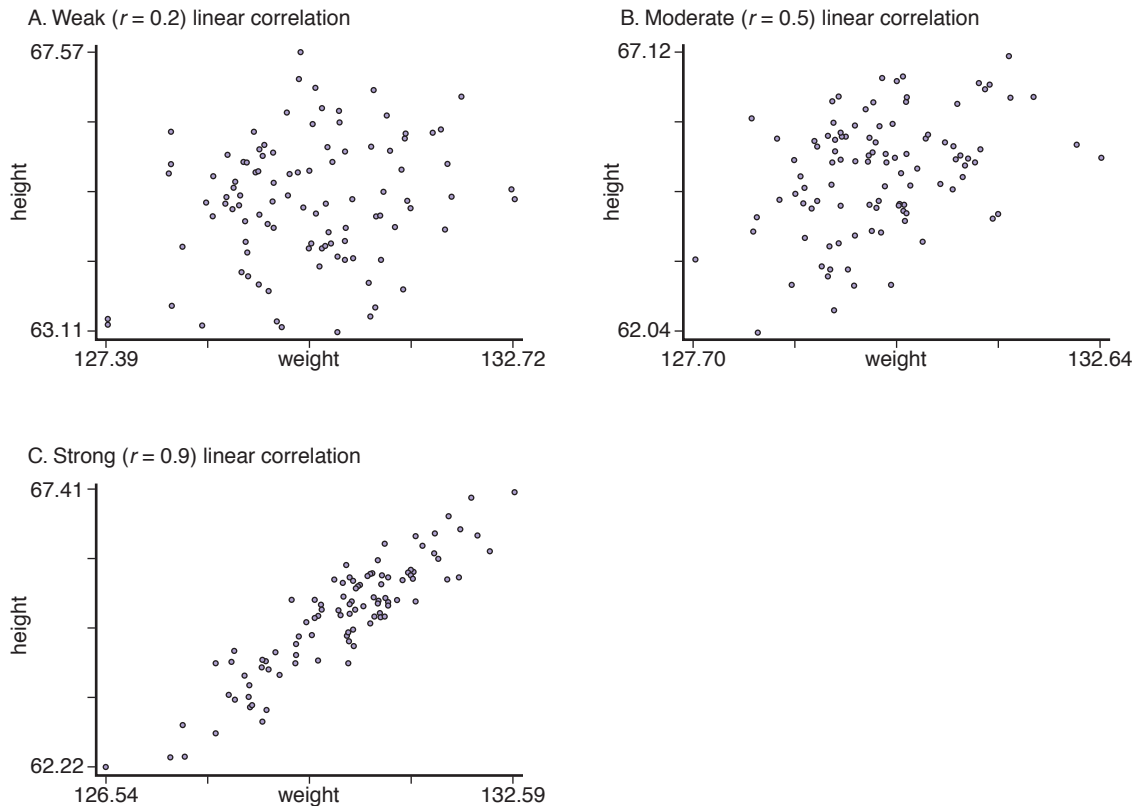


FIGURE 14-8 Graphical representation of weak, moderate, and strong linear correlations between height (inches) and weight (pounds).

TABLE 14-6 MEAN (SD) DMFT IN THOSE EXPOSED AND THOSE NOT EXPOSED TO THE PREVENTIVE PROGRAM

	<i>N</i>	MEAN DMFT (SD)
Exposed to Preventive Program	547	1.52 (2.03)
Not Exposed to Preventive Program	237	3.07 (2.91)

on the data shown, the correlation coefficient is -0.82 , indicating a strong, negative linear relationship. If we were to delete the outlier with the income of \$35,000 and the $DMFT = 1$, the correlation coefficient would become -1.0 , indicating a perfect negative linear relationship.

Comparing Means

Another outcome examined in the example study (detailed in Box 14-1) was DMFT in those exposed and not exposed to the dental preventive program. Here, the two variables being considered are DMFT and exposure status. DMFT may be considered a continuous variable, whereas exposure status is binary categorical. We begin to understand the relationship between exposure to the program and DMFT by reporting the measure of central tendency and spread of DMFT for each level of exposure. The authors provided the mean, as well as information that allowed us to determine SD. Such information may be summarized in a table, as shown in Table 14-6.

STATISTICAL INFERENCE

In our example study in Box 14-1, 52.8% of the children exposed to the preventive program and 71.3% of the children not exposed, respectively, had carious lesions in their permanent teeth. In this sample, a larger percentage of nonexposed than the exposed had carious lesions in their permanent teeth. Possibly, however, this

difference may just be caused by chance variation. For example, if you flipped a coin three times and it came up heads twice, you would not conclude that the coin was unfair: you would say that it was due to chance. Statistical inference can determine whether your results are likely due to chance, provided that you have chosen the appropriate study design and statistical approaches. **Statistical inference** consists of formal methods to draw conclusions from data taking into account chance variation. There are two major types of statistical inference: **confidence intervals** and **hypothesis testing**.

Confidence Intervals

Confidence intervals are used when we are estimating a population parameter. For example, we want to estimate the proportion of children not receiving the preventive program who have carious lesions in their permanent teeth in the entire study population of interest. This is the population parameter. However, we only have a sample of the population from which we generated a statistic. Based on our sample of 237 children not exposed to the program, this proportion is 71.3%; however, a different sample may have produced a different proportion. By calculating confidence interval, we can construct a margin of error around the statistic of 71.3%. Additionally, we can state how confident we are that the true population parameter will fall within the margin of error. Most often, a 95% confidence interval is constructed, which is the range of values that would cover the true population parameter 95% over time. Using a formula not shown here, the 95% confidence interval can be determined for the population proportion of children not exposed to the preventive program that have carious lesions in the permanent teeth to range from 65.5% to 77.1%. In other words, we are “95% confident” that the 65.5% to 77.1% of the children not exposed to the preventive program have carious lesions in their permanent teeth. This chapter does not detail how confidence intervals are calculated. There is no standard formula—it will depend on the parameter being estimated (e.g., proportion, mean, median), as well as the sampling design.

Essential to the calculation of all confidence intervals is the **standard error**. Suppose that we need to estimate the mean income of dental hygienists in the United States. To accomplish this goal, we took a random sample of hygienists. If we sampled two or three hygienists, the chances are good that some may earn little or some may earn a lot; therefore, our calculated mean may be far from the truth. By contrast, if we randomly sampled hundreds of hygienists, the sample mean income should fall close to the true population mean. The mean values determined from repeated samples of the same size are distributed around the true population mean in a bell-shaped curve with a SD (of the sample estimates of the mean incomes) equal to the SD of the incomes divided by the square root of the sample size. We call this SD of the sample estimates of the mean incomes the standard error. In practice, this implies a few points:

1. As a result of random variation, every sample mean calculated will be somewhat different.
2. Most sample means will be close to the population mean; however, at times, we will obtain a sample mean that differs greatly from the true population mean purely by chance.
3. The larger the sample size, the more tightly you expect the sample means to cluster around the population mean.

Hypothesis Testing

The second approach to statistical inference is hypothesis testing. The goal of hypothesis testing is to judge the evidence for a hypothesis. Hypothesis testing can be divided into four discrete steps: (i) formally stating the null and alternative hypotheses; (ii) choosing an appropriate statistical test; (iii) conducting the statistical test to obtain a ***p*-value**; and (iv) comparing the *p*-value against a fixed cutoff for

statistical significance— α (alpha). Typically, this value is set to 0.05. If a researcher is particularly rigorous, he or she may set it to 0.01.

We will discuss basic concepts and definitions and review the application of statistical testing to the various relationships discussed in the previous section. Note that Box 14-9 summarizes choosing among the statistical tests reviewed in this chapter: it does not include all possible statistical tests.

Essential to the concept of hypothesis testing is the *p*-value. The objective of hypothesis testing is to formally weigh the evidence against a **null hypothesis**. Usually, the null hypothesis (H_0) is a statement of no difference between or no effect of exposures (e.g., using the study in Box 14-1, H_0 may be that children who received the preventive program have the same mean DMFT as children who did not receive the preventive program). By contrast, the **alternative hypothesis**— H_A —is a statement of effect of exposure. In our example, the alternative hypothesis may be that the children who received the preventive program do not have the same mean DMFT as the children who did not receive the program. The *p*-value is the probability of a result being as far or further from what would be expected if the null hypothesis were true. Simply, you can think of the *p*-value as the probability that the results were obtained by chance. The smaller the *p*-value, the stronger the evidence in the data against the null hypothesis. Our decision about whether to reject the null hypothesis is based upon the *p*-value. Below a certain *p*-value, we will reject the null hypothesis. This certain value, the significance level, is denoted by the symbol α .

Hypothesis testing requires that we make a decision about whether to reject the null. As in any other decision-making process, errors may occur. Figure 14-9 depicts the two types of errors that may occur purely by chance. If the *p*-value

		Truth about the study population of interest	
		Null true	Alternative true
Decision based upon data from sample	Reject null	Type I Error (α)	Correct
	Fail to reject null	Correct	Type II Error (β)

FIGURE 14-9 Statistical errors.



BOX 14-9 Choice of Statistical Test for Independent Observations

		OUTCOME			
		BINARY	NOMINAL CATEGORICAL (>2 CATEGORIES)	ORDINAL CATEGORICAL (>2 CATEGORIES)	NON-NORMAL CONTINUOUS
EXPOSURE	BINARY	χ^2 or Fisher's exact	χ^2 or Fisher's exact	χ^2 , Fisher's exact, or Mann-Whitney <i>U</i>	<i>t</i> -test
	NOMINAL CATEGORICAL (>2 CATEGORIES)	χ^2 or Fisher's exact	χ^2 or Fisher's exact	χ^2 or Fisher's exact, or Kruskal-Wallis	ANOVA/ <i>t</i> -test
	ORDINAL CATEGORICAL (>2 CATEGORIES)	χ^2 or Fisher's exact	χ^2 or Fisher's exact	Spearman rank or χ^2	Spearman rank or linear regression
	NON-NORMAL CONTINUOUS	Logistic regression	Not covered in this chapter	Spearman rank	Spearman rank or linear regression
	NORMAL CONTINUOUS	Logistic regression	Not covered in this chapter	Spearman rank or linear regression	Pearson correlation or linear regression

is less than our cutoff α (usually 0.05 or 0.01), we will reject the null hypothesis. Suppose we conducted a hypothesis test of the H_0 that children who received the preventive program have the same mean DMFT as the children who did not receive the program. We set α to be 0.05 and got a p -value of 0.04, so we rejected the null hypothesis. Two things could have happened: First, there could be a true difference in the mean DMFTs of those who did and did not receive the preventive program. In this case, we correctly rejected the null hypothesis. Second, there may not be a true difference in the mean DMFTs of those who did and did not receive the program. In this case, we have incorrectly rejected the null hypothesis. We have committed an error, and this error has a name. If by chance we reject the null hypothesis when the null hypothesis is true, we have committed **Type I error**, also called α error (alpha error). It is called an α error because it is equivalent to the significance level discussed in the previous section. If our significance level is set at the typical value of 0.05, we will reject the null hypothesis 5% of the time when it really is true. Clearly, a Type I error is a concern only when we have rejected the null hypothesis. Now consider the opposite circumstance. Suppose that α is set to 0.05 with an obtained p -value of 0.09, failing to reject the null. Again, two things could have happened. If there is no difference between the mean DMFTs of children who did and did not receive the preventive program, then we were correct in failing to reject the null. However, if we simply failed to detect a true difference between the mean DMFTs, we have committed another type of statistical error. When we fail to reject the null, we are concerned about **Type II error**, the β error (beta error). β errors occur when you fail to reject the null when the alternative is true. A related term is power. **Power** is simply $1 - \beta$, the probability that you will reject the null, given that the alternative is true (Fig. 14-9).

CROSS-TABULATED DATA

Let us return to our example study, described in Box 14-1. Suppose that we would like to compare the proportions of children exposed and

not exposed to the preventive program who have carious lesions in their permanent teeth. First, we should state the null hypothesis. Usually, the null hypothesis is that the observations are a result of chance. In this case, it would be that any observed differences in the proportion of children with carious lesions in their permanent teeth are by chance; in other words, an equal proportion of children exposed and not exposed to the preventive program, respectively, have decay in their permanent teeth. By contrast, the alternative hypothesis is that there is a true effect of exposure. In this case, our alternative hypothesis would be that children exposed and not exposed to the preventive program are not equally likely to have decay in their permanent teeth.

Having explicitly stated the null and alternative hypotheses, we need to identify a statistical test that will help weigh the evidence against the null hypothesis. There are many statistical tests. Generally, you should follow three steps in selecting a test: (Step 1) specifically state the hypothesis to be tested; (Step 2) determine whether the data are independent; and (Step 3) determine the form of the exposure and outcome variables. We have completed Step 1. Determining whether data are truly independent sometimes can be difficult. Usually, results from the same individual or from matched individuals should not be considered independent. For example, if you were doing a study in which the unit of analysis was quadrants of the mouth and each subject contributed more than one quadrant, the data would not be independent. The analysis of nonindependent data can be complex and is beyond the scope of this chapter. Finally, you should review the form of the exposure and outcome variables. In our example, the exposure variable (preventive program) is binary categorical (two categories) and the outcome (presence of carious lesions in the permanent teeth) also is binary. In this case, the χ^2 (**chi-square**) test would be the correct statistical test. The data corresponding to this example have been shown previously (Table 14-4). We can use the information in this table to evaluate the null hypothesis.

TABLE 14-7 OBSERVED AND EXPECTED NUMBERS OF SUBJECTS WITH AND WITHOUT CARIOUS LESIONS IN THE PERMANENT TEETH BY EXPOSURE TO PREVENTIVE PROGRAM

CATEGORY	OBSERVED	EXPECTED
Exposed: No Carious Lesions	258	228
Exposed: Carious Lesions	289	319
Not Exposed: No Carious Lesions	68	99
Not Exposed: Carious Lesions	169	138

To better understand the test, we will first answer two questions. First, using Table 14-4, you should be able to identify the proportion of subjects in this sample (both groups combined) who had decay in their permanent teeth. There were 784 subjects and 458 had carious lesions in their permanent teeth; therefore, $458/784 = 58.4\%$ who had carious lesions in their permanent teeth. If the null hypothesis is true, there is no difference in the proportion of subjects with carious lesions in their permanent teeth between the two groups. Each group should have approximately the same proportion of subjects with decay in their permanent teeth (i.e., 58.4%). Looking at Table 14-4, 547 subjects were exposed to the preventive program. If the null hypothesis were true, 319 children ($58.4\% \times 547 = 319$ children) exposed to the preventive program would be expected to have carious lesions in their permanent teeth. Similarly, 138 of the 237 children not exposed to the preventive program would be expected to have carious lesions in their permanent teeth. The χ^2 statistic can be thought of as a

quantitative comparison between what you would expect to see if the null hypothesis were true and what was actually observed. To facilitate this calculation, the observed and expected values are shown in Table 14-7.

If the null hypothesis were true, there should be small differences between the observed and expected values. The χ^2 statistic is based on this. To compute the χ^2 statistic, you have to complete three steps for each category (cell of the table):

1. Compute the difference between the observed and the expected values ($O - E$).
2. Square the difference ($O - E$)².
3. Divide the squared difference by the expected value ($O - E$)²/ E .

Finally, sum the values obtained in step three across all categories. The formula corresponding to these steps may be found in Box 14-10. The results of these steps applied to our example are summarized in Table 14-8. Therefore, the χ^2 statistic is 23.44. To interpret this statistic, recall that if the null hypothesis were true, the χ^2 statistic should be small. If we observe a large value χ^2 statistic, we tend to reject the null, whereas if we observe a small value, we fail to reject the null. To make this objective, we rely on statistical tables that show the probability of χ^2 being above certain values when the null hypothesis is true. Generally, we reject the null when the probability of the observed χ^2 value being under the null is 5% or less, setting α error to 0.05. For a 2×2 table, such as we are discussing, the critical cutoff value corresponding to the 5% level is 3.84. As our χ^2 statistic is far greater than 3.84, we reject the null hypothesis that the same proportions of children exposed

TABLE 14-8 CALCULATIONS NECESSARY TO DETERMINE THE CHI-SQUARE STATISTIC TO ASSESS THE RELATIONSHIP BETWEEN EXPOSURE TO THE PREVENTIVE PROGRAM AND CARIOUS LESIONS

CATEGORY	OBSERVED (O)	EXPECTED (E)	(O - E)	(O - E) ²	(O - E) ² /E
Exposed: No Carious Lesions	258	228	30	900	3.95
Exposed: Carious Lesions	289	319	-30	900	2.82
Not Exposed: No Carious Lesions	68	99	-31	961	9.71
Not Exposed: Carious Lesions	169	138	31	961	6.96
				Total	23.44



BOX 14-10 χ^2 (Chi-Square) Test

The χ^2 test is used to analyze $R \times C$ tables, provided you have a sufficient number of subjects in each cell. Its two steps are:

1. The χ^2 statistic should be calculated using the following formula:

$$\chi^2 = \sum \frac{(\text{Observed} - \text{Expected})^2}{\text{Expected}} = \sum \frac{(O - E)^2}{E}$$

where $(O - E)^2/E$ is calculated for each category or cell in the table.

2. The χ^2 statistic calculated in step 1 is compared with a tabulated critical cutoff value corresponding to the DF to determine whether we accept or reject the null hypothesis. For convenience, the 5% ($\alpha = 0.05$) and 1% ($\alpha = 0.01$) critical cutoffs of the χ^2 distribution for DF from 1 to 10 are listed below.

DEGREES OF FREEDOM	5% CRITICAL VALUE	1% CRITICAL VALUE
1	3.8415	6.6349
2	5.9915	9.2103
3	7.8147	11.3449
4	9.4877	13.2767
5	11.0705	15.0863
6	12.5916	16.8119
7	14.0671	18.4753
8	15.5073	20.0902
9	16.9190	21.6660
10	18.3070	23.2092

and not exposed to the preventive program have carious lesions in their permanent teeth.

Because the χ^2 statistic is obtained by summing $(O - E)^2/E$ over all cells, with greater numbers of categories, the χ^2 statistic will tend to increase. Thus, to adjust for this, we need to change our critical cutoff value. This adjustment is related to another concept discussed later in this chapter—**degrees of freedom** (DF). DF may be considered the number of unconstrained units of information in the data. This may seem a bit abstract; the idea is most easily conceptualized when applied to $R \times C$ tables. We have already discussed the simplest form of an $R \times C$ table: the 2×2 table.

Generally, a table with R rows and C columns is an $R \times C$ table. Suppose that our example study had three exposures: (i) no intervention, (ii) sending educational materials home to the parents, and (iii) a complete caries preventive program. Again, suppose that at the end of the programs we would like to compare the proportions of children with carious lesions in their permanent teeth across the levels of exposure. Because our exposure is multiple categorical and our outcome is binary, we would use the χ^2 test to test the null hypothesis that those children receiving no preventive program, the educational program, and the full preventive

TABLE 14-9 HYPOTHETICAL CROSS-TABULATION OF EXPOSURE STATUS AND PRESENCE OF CARIOUS LESIONS IN PERMANENT TEETH

	CARIOUS LESIONS IN PERMANENT TEETH	NO CARIOUS LESIONS IN PERMANENT TEETH	TOTAL
Full Preventive Program	289	258	547
Education Alone	287	156	443
No Prevention	169	68	237
Total	745	482	

program, respectively, are equally likely to have carious lesions in their permanent teeth. First, we would generate a 3×2 table to show the hypothetical results, as in Table 14-9, showing the row and column totals. To understand DF, consider these totals to be fixed quantities and the cells inside the table to be variable. You may see that when two inner cells are filled, restrictions would be placed on other cells—only two cells can be given numeric values freely. After you know how many people are in two of the cells, you can calculate the number of people in all of the other cells. In general, an $R \times C$ table has $(r - 1) \times (c - 1)$ DF; in this case, there are $(3 - 1) \times (2 - 1) = 2$ DF.

To calculate the χ^2 statistic, go through the previously outlined steps, adding the $(O - E)^2/E$ across all cells. The χ^2 statistic would be 28.48. Then consult the χ^2 table for DF = 2. Looking at Box 14-10, you can see that 28.48 is greater than not only the 5% level critical cutoff (5.9915) but also the 1% critical cutoff (9.2103), giving strong evidence to reject the null hypothesis.

CORRELATION

Previously, we considered a hypothetical relationship between two continuous variables (income and DMFT). The scatter diagram shown as Figure 14-7 showed a negative relationship; as income increased, DMFT tended to decrease. The correlation coefficient (r) describing the

relationship was -0.82 . If there were no linear relationship between income and age, r would be 0, so it makes sense that our null hypothesis is $r = 0$. The alternative is simply that $r \neq 0$, that there is a linear relationship between income and DMFT. Assuming that income and DMFT are normally distributed, we would then calculate a Pearson correlation coefficient and perform a statistical test to determine the probability that the difference between this correlation coefficient and 0 is a result of chance. This statistical test is a form of ***t*-test** (a one-sample *t*-test), which compares the correlation coefficient obtained to 0. The two-sample *t*-test is described in more detail in the next section. In running the test, we would obtain a *p*-value of 0.02. Comparing this to the customary cutoff of $\alpha = 0.05$ (5%), we would reject the null hypothesis and conclude that there is a statistically significant, strong, negative linear relationship between income and DMFT.

COMPARING MEANS

In an earlier section (Table 14-6), we reviewed the mean DMFT in those exposed and not exposed to the dental preventive program described in the example study (Box 14-1). We will now illustrate how to conduct a statistical test when the exposure variable is binary and the outcome variable is continuous. If there was no relationship between the exposure to the preventive program and the mean DMFT, we would expect the difference between the mean DMFTs of those exposed to the preventive program (μ_p) and those not exposed to the preventive program (μ_{np}) to equal 0. Thus, we could state our null hypothesis, H_0 , as $\mu_p - \mu_{np} = 0$. Our alternative hypothesis, H_A , would be that the difference between the two means is not equal to 0, or, $\mu_p - \mu_{np} \neq 0$. If DMFT were normally distributed, the two-sample *t*-test would be used to evaluate this null hypothesis. The *t*-statistic would be calculated using the mean DMFT, the SD of DMFT, and the number of subjects in each exposure group. The formula for the *t*-statistic is found in Box 14-11. In this case, the *t*-statistic = 8.55. One can then use the *t*-statistic to look up the probability of this result, given that



BOX 14-11 The *t*-test

When you want to test whether two independent groups have the same mean of a normally distributed continuous variable, use the two-sample unpaired *t*-test. Here, the numbers of subjects, means, and SDs of each group are referred to as: n_a and n_b , μ_a and μ_b , and s_a and s_b , respectively.

1. Stating the null hypothesis. The null hypothesis, when conducting a *t*-test, is that the mean of group a is equal to the mean of group b. Thus, the null may be stated as $H_0: \mu_a = \mu_b$, and the alternative may be stated as $H_A: \mu_a \neq \mu_b$.
2. Calculating the *t*-statistic. To perform the *t*-test, we assume that the samples came from populations in which the continuous variable is normally distributed with means μ_a and μ_b , respectively, and a common unknown variance. Under these assumptions, the sample variance of the difference in sample means is given by the pooled variance:

$$(s_{\bar{x}_a - \bar{x}_b})^2 = \left(\frac{1}{n_a} + \frac{1}{n_b} \right) \left(\frac{(n_a - 1)s_a^2 + (n_b - 1)s_b^2}{(n_a + n_b - 2)} \right)$$

The test statistic *t* is calculated by dividing the difference in sample means by the SD of their difference. Recall that the SD is the square root of the variance.

$$t = \frac{\bar{x}_a - \bar{x}_b}{\sqrt{(s_{\bar{x}_a - \bar{x}_b})^2}} = \frac{\bar{x}_a - \bar{x}_b}{s_{\bar{x}_a - \bar{x}_b}}$$

3. Two-tailed *t*-distribution. When you have calculated the *t*-statistic, you can identify the corresponding probability under the null by consulting the appropriate DF row of the *t*-table. The DF can be determined by subtracting 2 from the total number of subjects in both groups ($n_a + n_b - 2$). Below you will find the 5% and 1% critical values for the two-tailed *t*-distribution.

DEGREES OF FREEDOM (DF)	5% CRITICAL VALUE	1% CRITICAL VALUE	DEGREES OF FREEDOM (DF)	5% CRITICAL VALUE	1% CRITICAL VALUE
1	12.7062	63.6567	16	2.1199	2.9208
2	4.3027	9.9248	17	2.1098	2.8982
3	3.1824	5.8409	18	2.1009	2.8784
4	2.7764	4.6041	19	2.0930	2.8609
5	2.5706	4.0321	20	2.0860	2.8453
6	2.4469	3.7074	30	2.0423	2.7500
7	2.3646	3.4995	40	2.0211	2.7045
8	2.3060	3.3554	50	2.0086	2.6778
9	2.2622	3.2498	60	2.0003	2.6603
10	2.2281	3.1693	70	1.9944	2.6479
11	2.2010	3.1058	80	1.9901	2.6387
12	2.1788	3.0545	90	1.9867	2.6316
13	2.1604	3.0123	100	1.9840	2.6259
14	2.1448	2.9768	Infinite	1.9600	2.5759
15	2.1314	2.9467			

the null hypothesis is true, on a t -table. Similar to the χ^2 distribution table, the probability associated with a given t -statistic depends on the DF. For the t -test, the DF would equal the sum of the number of subjects in each of the groups -2 ; in this case, it would be $(547 + 237 - 2) = 782$. As there are increasingly greater DF, the critical cutoff values for a given probability under the null change less and less. For example, consulting the selection of critical values shown in Box 14-11, you can see that the $\alpha = 5\%$ critical value for $DF = 60$ is 1.980, whereas the 5% critical value for infinite DF is 1.9600. To be more conservative, in this case, we will look at the critical values for $DF = 100$. Because our t -statistic of 8.55 exceeds the 5% and 1% critical values, we conclude that we can reject the null hypothesis at both $\alpha = 0.05$ and the stricter criterion of $\alpha = 0.01$. Another way this might be put is that there is a statistically significant difference between the mean DMFTs of children exposed and not exposed to the preventive program, with $p < 0.01$.

If you want to compare the mean of a normally distributed continuous variable across levels of a categorical variable with more than two levels, you should use **analysis of variance (ANOVA)** and the accompanying F -test. The F -test is a generalization of the t -test; they are equivalent when comparing two means. As an example, return to the hypothetical analysis of three programs: no prevention, a preventive program consisting only of educational materials being sent home to the parents, and a full preventive program. Suppose that we now wish to compare the mean DMFT among the three groups. We will abbreviate the mean DMFT in the full prevention program as μ_{fp} , in the education alone as μ_e , and in the no prevention group as μ_{np} . Table 14-10 shows the hypothetical mean DMFTs and SDs for the three groups. The null hypothesis would be that the mean DMFT is the same in all three groups; $H_0: \mu_{fp} = \mu_e = \mu_{np}$. The alternative hypothesis is that not all of the means are equal.

The appropriate statistical procedure in this situation is ANOVA and the F -test. Using ANOVA, we separate the data variability into

TABLE 14-10 MEAN (SD) DMFT IN THE THREE LEVELS OF PREVENTION EXPOSURE IN A HYPOTHETICAL STUDY

	<i>N</i>	MEAN DMFT (SD)
Full Preventive Program	547	1.52 (2.03)
Education Alone	443	2.75 (2.07)
No Prevention	237	3.07 (2.91)

two parts: between-group variability and within-group variability. Between-group variability is the variation between each group mean and the overall mean for all groups; within-group variability is the variation between each subject and their group mean. If the between-group variability far exceeds the within-group variability, there are likely to be differences in group means. The F -ratio quantitatively summarizes this by dividing the between-group variance by the within-group variance. A detailed discussion of the calculation of the F -ratio is beyond the scope of this chapter. An F -ratio = 1 would occur if the between-group variability equals the within-group variability; the F -ratio increases as the between-group variance grows relative to the within-group variance. The F -test assesses whether the observed treatment group differences are statistically significant. Although not explicitly shown here, the general steps are the same as for the other statistical tests: calculating the F -ratio from the data set and referring to the tabulated value at the appropriate critical value for the corresponding DF. In the F -test, there are two DF: one corresponding to the between-groups and one to the within-groups. Thus, the critical value on the F -distribution depends upon the α error selected, as well as both DF. In our example, the F -ratio was 55.93, with $DF = 2$ and 1224. This exceeds the critical value for both $\alpha = 5\%$ and 1%; therefore, we reject the null hypothesis that all of the exposure groups have the same mean DMFT. However, this does not explicitly reveal the differences among the



BOX 14-12 ANOVA and *F*-Test

Use ANOVA and the *F*-test to compare the means of a continuous, normally distributed outcome across three or more groups. You must also assume that the data from all treatment groups have the same variance. Here, assuming three groups, the numbers of subjects, means, and SDs of each group are referred to as: n_a , n_b , and n_c ; μ_a , μ_b , and μ_c ; and s_a , s_b , and s_c , respectively. The total number of groups (exposure levels) is referred to as K , and the total number of subjects in all groups is referred to as N .

1. Stating the null hypothesis. The null hypothesis is that all of the groups have the same mean. Therefore, the null and alternative may be stated as $H_0: \mu_a = \mu_b = \mu_c$, and H_A : not all μ s are equal.
2. Calculating the *F*-ratio.

$$F = \frac{\text{Between-group variance}}{\text{Within-group variance}}$$

The details of the calculation of the *F*-ratio are beyond the scope of this chapter; however, you should know that as the *F*-ratio increases, evidence against the null hypothesis mounts.

3. *F*-Distribution

Once you have calculated the *F*-ratio, you can identify whether it exceeds the critical value for your set α by consulting the appropriate cell of the *F*-distribution table. The appropriate cell is identified using the set α error, the DF for the numerator of the *F*-ratio, and the DF for the denominator of the *F*-ratio. The DF for the numerator of the *F*-ratio is (number of groups $- 1$), ($K - 1$). The DF for the denominator of the *F*-ratio is (total number of subjects $-$ total number of groups), ($N - K$).

three groups. This significant ANOVA result may indicate that all three means differ from one another. Alternately, it may indicate that the mean DMFTs of the no prevention and the education groups differ from the mean DMFT of the full prevention program groups but not from each other. To get this information, we would have to run a post-test, which is beyond the scope of this chapter (Box 14-12).

Exact and Nonparametric Statistical Tests

The tests discussed rely on meeting various assumptions. Because it can be unreasonable to make these assumptions, approaches must be taken that are not dependent on them: exact and nonparametric statistical tests. This chapter does not review these tests in detail but simply

introduces the circumstances in which they may be employed. When examining cross-tabulations, we can use the χ^2 test only if there are sufficient numbers of subjects in each cell of the table. If there are not at least five subjects per cell, we must use Fisher's exact test. In correlation, if the variables are not normally distributed, the Spearman rank correlation should be used instead of the Pearson correlation. When comparing the distribution of a continuous variable between two groups, the Mann-Whitney *U* test should be used instead of the *t*-test when the continuous variable is not normally distributed. If comparing the distribution of a continuous variable among three or more groups, the Kruskal-Wallis test should be used instead of ANOVA/*F*-test if the continuous variable is not normally distributed.

ASSOCIATION, CAUSATION, AND BIAS

Association between two variables does not necessarily indicate causation. In the example study (Box 14-1), there is a statistically significant association between exposure to the preventive program and a lower relative DMFT. This does not necessarily mean that the preventive program caused the lower DMFT. There are many other potential explanations for the observed association. Chance/random error (Type I error) is one explanation, but there are errors that are not attributable to chance—systematic errors.

This systematic error is called bias. **Bias** is a consistent, repeated divergence in the same direction of the sample estimate from the true population value. For example, when a thermometer always reports the temperature to be 5°C lower than it truly is, the temperatures that are recorded using this thermometer will be biased. Bias can occur in many forms.⁵ To illustrate this point, we will discuss an example of information bias. Information bias can occur whenever there are errors in the measurement of variables. In our study, the investigators measured DMFT. Suppose that when they encountered a questionable carious lesion, they were more likely to classify it as a lesion if the child had not been exposed to the preventive program. Thus, independent of any effect of the preventive program, the children not exposed to the preventive program would appear to have a higher mean DMFT than those exposed.

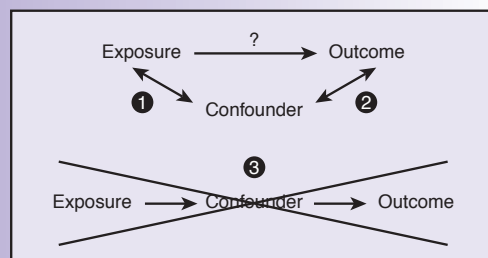
A frequently encountered type of bias is **confounding** bias. To illustrate this, consider what would happen if those children exposed to the preventive program were of higher social class than those children not exposed to the preventive program. Even if they were not exposed to the preventive program, children of higher social class, as a group, would likely have a lower DMFT. If this were the case, social class, rather than the preventive program, may be responsible for the observed differences in DMFT between the exposure groups. This would be an example of confounding. The effects of two variables (in this case, exposure to preventive program and social class) on an outcome (here, DMFT) are said to be



BOX 14-13 Confounding

A confounding factor must possess three characteristics:

1. It must be associated with exposure.
2. It must be associated with disease, even among the unexposed.
3. It must not be an intermediate on the causal pathway between exposure and disease.



confounded when they cannot be distinguished from one another. We would then call social class a confounder or a confounding factor. To be a confounding factor, a variable must possess certain characteristics: (i) it must be associated with the exposure; (ii) even among the unexposed, it must be associated with the outcome; and (iii) it must not be an intermediate step in the path between exposure and disease. These concepts are graphically illustrated in Box 14-13.

One can control for confounding bias in the design phase or the analysis phase of the study. Three approaches to confounding control in the design phase are restriction, matching, and randomization. With restriction, you limit the eligible subjects to those who are in one category of the confounding variable. Referring back to the example in the previous paragraph, if you were to enroll only subjects classified as upper social class, it would limit confounding by social class because it would break the necessary link between exposure and the confounding factor. Both children exposed and not exposed to the preventive program would be equally likely to be

of upper social class because all subjects would be of upper social class. With matching, for every subject of upper social class assigned to the preventive program, you would assign a person of upper social class to not be exposed to the program. You would do the same with subjects of lower social class. In this way, the exposure groups would be balanced in terms of social class. A final approach would be to randomize exposure. A randomized trial is an experimental study in which exposure is randomly assigned. In this way, given a sufficiently large number of subjects, the exposed and the nonexposed are likely to have the same characteristics. Additionally, randomization is the only way to control for known and unknown confounders.

In the analytic phase, you can control for known confounding factors, provided that you collected data on these factors. This chapter covers two approaches: stratification and regression. Stratification in the analysis phase is analogous to restriction in the design phase. To control for the confounding factor, we would examine the relationship between exposure and disease in strata, or levels, of this factor. In our example study (Box 14-1), the authors examined the relationship between exposure to the preventive program and presence of carious lesions in the permanent teeth (Table 14-4 and Table 14-11A). They found that the risk ratio between exposure and outcome was 0.74. Again, imagine that those exposed were more likely to be of upper social class and that social class is negatively associated with presence of carious lesions in the permanent teeth. In other words, social class is a confounder. To control for this confounding, we may stratify by social class. If social class had two levels, high/middle and low, we would create two 2×2 tables, as shown in Table 14-11 B and C.

You can see how the estimate of the risk ratio changes when we control for social status: exposure has a smaller effect. By controlling for confounding, we come closer to the true causal effect of the preventive program on the proportion of children with carious lesions in the permanent dentition. Stratification works well when you want to control only for a single confounding factor, but not when there are multiple

TABLE 14-11 A TO C OVERALL AND ADJUSTED (SOCIAL CLASS) RELATIONSHIP BETWEEN EXPOSURE TO THE PREVENTIVE PROGRAM AND PRESENCE OF CARIOUS LESIONS IN PERMANENT TEETH

A. Overall

	CARIOUS LESIONS IN PERMANENT TEETH	NO CARIOUS LESIONS IN PERMANENT TEETH	TOTAL
Exposed to Program	289	258	547
Not Exposed to Program	169	68	237
Total	458	326	

RR = 0.74

B. High/Middle Social Class

	CARIOUS LESIONS IN PERMANENT TEETH	NO CARIOUS LESIONS IN PERMANENT TEETH	TOTAL
Exposed to Program	160	241	401
Not Exposed to Program	81	101	182
Total	241	342	

RR = 0.9

C. Low Social Class

	CARIOUS LESIONS IN PERMANENT TEETH	NO CARIOUS LESIONS IN PERMANENT TEETH	TOTAL
Exposed to Program	82	54	136
Not Exposed to Program	37	18	55
Total	119	72	

RR = 0.9

confounding factors because you have to create a stratum for each combination of factors. For example, if you have two binary confounding factors (e.g., gender and social status), you would have to consider four strata (male upper class, female upper class, male lower class, female

lower class). For the same reason, when the confounding factor is continuous, stratification would be impossible. In these cases, one relies on multivariate regression techniques.

LINEAR AND LOGISTIC REGRESSION

There are several types of regression analyses. Here, we introduce linear and logistic regression, defined in Box 14-14. The subtleties of regression are beyond the scope of this chapter. For more detail, read *Fundamentals of Biostatistics*.⁶ Unless you are very familiar with these techniques, it would be best to consult a biostatistician to assist you in performing regression.

Linear Regression

Linear regression assesses the relationship between a single, continuous outcome variable and one or more explanatory variables (e.g., exposures, confounding factors). When there is one explanatory variable, the technique is called bivariate regression. If there is more than one explanatory variable, it is called multivariate regression. The explanatory variables may take any form, continuous or categorical. The outcome variable is sometimes referred to as the dependent variable; the explanatory variables are referred to as independent variables. The

value of the dependent variable depends upon the values of the independent variables. Several assumptions must be met to validly perform linear regression, which are beyond the scope of this book. Conducting linear regression results in the estimation of a linear equation relating the dependent to the independent variables. Let us first consider relating a single continuous outcome to a single exposure, returning to the hypothetical relationship between income and DMFT (Fig. 14-7). The equation resulting from this simple linear regression is in the familiar form of $y = mx + b$, where y is the value of the dependent variable, x is the value of the independent variable, m is the slope (also called the linear regression coefficient or β), and b is the intercept. In this case, the equation is $\text{DMFT} = -0.00014 (\text{income}) + 7.94$. The intercept is the value of the dependent variable (y , DMFT in this case) when the independent variable (x , income in this case) is 0. Thus, the linear regression predicts that those with an income = 0 would have a $\text{DMFT} = 7.94$. You interpret the linear regression coefficient as you would any slope: for every one-unit (dollar) increase in income, there is a 0.00014 decrease in DMFT. You may also conduct hypothesis testing on this coefficient. The null hypothesis is that the linear regression coefficient = 0. The alternative is that $\beta \neq 0$, in other words, that there is a linear relationship between



BOX 14-14 Linear and Logistic Regression

Simple linear regression: Used to evaluate the linear relationship between a single continuous dependent variable (outcome) and a single independent variable (exposure).

Multiple linear regression: Used to evaluate the linear relationship between a single continuous dependent variable (outcome) and two or more independent variables (e.g., exposures, confounding factors).

Simple logistic regression: Used to evaluate the relationship between a single binary dependent variable (outcome) and a single continuous or categorical independent variable (exposure).

Multiple logistic regression: Used to evaluate the relationship between a single binary dependent variable (outcome) and two or more independent variables (e.g., exposures, confounding factors).

income and DMFT. As with any hypothesis test, a p -value would result. In this case, the p -value associated with income is 0.022, which is below the threshold of $\alpha = 0.05$. In this way, we would reject the null hypothesis and conclude that there is a statistically significant linear relationship between DMFT and income. Beyond determining the presence of a linear relationship, linear regression equations may be used to predict the value of the dependent variable, given the values of the independent variable(s). In our example, we would predict that someone with an income of \$38,000 would have a DMFT of $-0.00014(38,000) + 7.94 = 2.62$. To have a prediction model that included more than one independent variable or to control for confounding of an exposure–outcome relationship, you would use multiple linear regression. For example, suppose that we wanted to examine the relationship between income and DMFT, controlling for gender, because we suspect that gender may be a confounding factor. Let us say that we obtained the following equation: $\text{DMFT} = -0.00019(\text{income}) + 0.93(\text{gender}) + 7.9$. Focusing on the coefficient associated with income, we can see that controlling for gender, for every one-unit increase in income, there is a 0.00019 decrease in DMFT. This is a different estimate than we obtained when we did not control for gender because we have removed the effects of confounding by gender. To fully interpret this equation, you would need to know that gender is coded as 0 for females and 1 for males. Thus, the interpretation of the coefficient associated with gender is that, controlling for income, males have a 0.93 higher DMFT than females.

Logistic Regression

Logistic regression examines the relationship between a single, binary outcome variable and one or more explanatory variables (e.g., exposures, confounding factors). As with linear regression, logistic regression can be bivariate (one explanatory variable) or multivariate (more than one explanatory variable), and the explanatory variables may take any form. The terms dependent variables and independent variables refer to

outcome and explanatory variables, respectively. Several assumptions, which are beyond the scope of this chapter, need to be met to validly perform logistic regression. Logistic regression results in odds ratio(s) describing the relationships between the outcome and explanatory variable(s). Here, we will focus on the interpretation of the odds ratio associated with a binary exposure. To illustrate, in our example study (Box 14-1), the authors first conducted a simple logistic regression analysis to examine the relationship between exposure to the preventive program and suffering from caries during the 7.5-year follow-up, both binary variables. They found an odds ratio of 0.42. Interpreting this as a risk ratio, those children exposed to the preventive program were 58% less likely to have experienced carious lesions during the follow-up period than those children who were not exposed. You may conduct hypothesis testing on this odds ratio to obtain a p -value. The null hypothesis would be that there is no relationship between exposure to the preventive program and experience of carious lesions 7.5 years after beginning the intervention; in other terms, the null hypothesis would be that the odds ratio = 1. The alternative hypothesis would be that the odds ratio $\neq 1$. The authors conducted the test; the result was a p -value = 0.0001, indicating that we can reject the null hypothesis. Next, the authors conducted multiple logistic regression; this allowed them to examine the relationship between exposure (prevention program) and outcome (one or more carious lesions during the 7.5 years of follow-up), controlling for carious lesions at the beginning of the study, gender, malocclusion, presence of posterior cross-bite, and social class. Controlling for these factors, the odds ratio relating the preventive program to the experience of carious lesions was 0.40, almost identical to that obtained from the simple logistic regression.

GUIDELINES FOR INFERRING CAUSALITY

As we discussed previously, researchers usually try to identify causation rather than just association. This certainly applies to the use of statistics to evaluate dental public health interventions; you want to be sure that any relationship you detect between



BOX 14-15 Six Standards for Causality

1. **Strength.** Stronger associations may be more likely to be causal than are weak associations.
2. **Consistency.** Consistent associations are those that are observed across various populations and circumstances. You should keep in mind, however, that some effects occur only in rare circumstances.
3. **Temporality.** A cause must precede an effect. This is a necessary standard for causality.
4. **Dose–Response.** As the “dose” of the cause increases, the likelihood of the effect occurring increases. However, there are some instances in which the effect does not follow the cause until a “threshold” level of the causal agent is present.
5. **Plausibility.** A causal relationship should be biologically plausible. Keep in mind, however, that the perception of plausibility may be limited by current understanding.
6. **Experimental evidence.** Experimental evidence provides a test of the causal hypothesis, but this is not always possible or ethical to obtain.

an intervention and an outcome is a result of the intervention, rather than some other explanation. In 1965, Hill proposed a commonly referenced set of standards for evaluating causality.⁷ Six of his criteria were strength, consistency, temporality, dose–response, plausibility, and experimental evidence. These criteria are assigned brief explanations in Box 14-15. Other than temporality, which is absolutely necessary to establish cause and effect, these criteria should not be viewed as rigid requirements; they are simply guidelines.

STATISTICAL VERSUS CLINICAL SIGNIFICANCE

Because a result is statistically significant, it does not mean that it is clinically significant. When a null hypothesis can be rejected (because the p -value is less than your cutoff α), there is good evidence that an effect is present; however, that effect may be so small as to be clinically meaningless. A small p -value, such as 0.0001, does not mean that there is a strong association; it simply means that there is strong evidence for some association. For example, suppose that the study described in Box 14-1 found a statistically significant association between exposure to the preventive program and mean DMFT, with a p -value of 0.04. We should ask the question: How large was the difference between the mean

DMFTs? If those who received the preventive program had a mean DMFT of 1.0 and those who did not receive the preventive program had a mean DMFT of 5.0, the results would be more clinically important than if the children who did not receive the program had a mean DMFT of only 1.25. It is essential that you judge clinical significance on the basis of the magnitude of effect, rather than on p -value alone.

Summary

The chapters thus far in Module 4 have given you a foundation in epidemiology and biostatistics. A basic understanding of these sciences is essential to the conduct of every stage of evidence-based public health practice: defining the problem, planning the initiative, implementing the initiative, and evaluating the program. Equally important, however, is the application of this knowledge to critically review published literature. This is the concern of Chapter 15.

Resources

Moore DS. Statistics: Concepts and Controversies. New York, NY: W.H. Freeman, 1991
 Norman GR, Streiner DL. PDQ Statistics. Hamilton, ON, Canada: B.C. Decker, 1999

Weintraub JA, Douglass CW, Gillings DB.
Biostats: Data Analysis for Dental Health Care
Professionals. Chapel Hill, NC: CAVCO, 1985

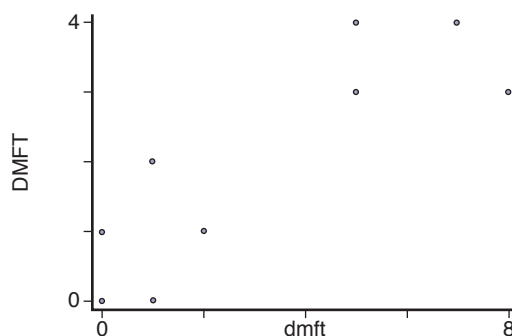
Review Questions

- From the following selections (a–d), classify gender, race, and temperature in terms of type of variable.
 - Binary nominal categorical
 - Nominal categorical with >2 categories
 - Ordinal categorical
 - Continuous
- What is the median of the following numbers: 12, 0, 5, 4, 10, 10, 8, 2, and 3?
 - 5
 - 10
 - 6
 - 4.5
- What is the SD of the series of numbers in Question 2?
 - 15.3
 - 16.3
 - 3.9
 - 6.2
- Consider a standard normally distributed variable Z . Determine the probability that it will lie between -2 and -1 .
 - 13.6%
 - 84.1%
 - 15.9%
 - 2.3%
- A hypothetical cohort study was conducted on the relationship between current smoking and the presence of gingivitis or periodontal disease. The study yielded the following 2×2 table:

	GINGIVITIS OR PERIODONTAL DISEASE PRESENT	GINGIVITIS OR PERIODONTAL DISEASE ABSENT	TOTAL
Current Smoker	50	50	100
Not Current Smoker	50	100	150
Total	100	150	250

What is the risk ratio describing the relationship between current smoking and gingivitis and periodontal disease in the population?

- 0.50
 - 0.33
 - 1.75
 - 1.52
- A longitudinal study was conducted to determine the relationship between decayed, missing, or filled primary teeth (dmft) in first grade and DMFT in fifth grade. The scatter diagram of dmft versus DMFT looks like this:



How would you describe the linear relationship between dmft and DMFT?

- Positive
 - Negative
 - Nonexistent
 - Not enough information provided
- A study was conducted to determine the relationship between flossing and the number of sites that bled on periodontal probing (BOP). Flossing was classified as daily, less than daily, and never. Assuming BOP was normally distributed, what statistical test would you use to formally assess the null hypothesis that daily flossers, less than daily flossers, and never flossers have the same mean BOP?
 - t -test
 - Correlation
 - Mann–Whitney U test
 - ANOVA/ F -test

8. A hypothetical cohort study was conducted on the relationship between presence of periodontal disease and subsequent development of coronary heart disease. Both variables were binary categorical. The authors calculated the risk ratio to be 1.5. What is your interpretation of the risk ratio?
- 1.5 more people with periodontal disease developed coronary heart disease.
 - Those people with periodontal disease were 1.5 times more likely to develop coronary heart disease.
 - Those people with coronary heart disease were 1.5 times more likely to develop periodontal disease.
 - 1.5 more people with coronary heart disease developed periodontal disease.
9. Return to the example in Question 8. By conducting a statistical test, the authors found the p -value to be below the set α level of 0.05. What type of statistical error may you be concerned about?
- None
 - β error
 - α error
 - Sampling error
10. Does statistical significance always imply clinical significance?
- Yes
 - No

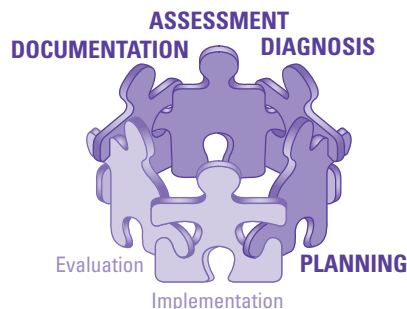
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Objectives

After studying this chapter and completing the study questions and activities, the learner will be able to:

- Define evidence-based dentistry.
- Describe how scientific information is transferred to health professionals and the public.
- Access and assess the quality and applicability of information found in the scientific and public literature.
- List and describe sections of a scientific article.
- Describe different methods of communicating scientific information.
- Select an appropriate mode of communicating a new concept or information.
- Create and deliver a scientific presentation.



KEY TERMS

Abstract
Critical review
Discussion
Evidence-based dentistry (EBD)
Juried
Literature review
Literature search

MEDLINE
Methodology
Oral presentation
Original source
Peer-reviewed
Poster
PubMed

Refereed
References
Results
Round table
Secondary source
Table clinic
Title

See Appendix 3 for the ADEA competencies addressed in this chapter.¹

Introduction

It is the responsibility of scientists and innovators in a particular discipline to relate information, ideas, and results in a clear and concise manner. This facilitates the transfer of information from the point of discovery to potential users, including health professionals and the public at large. It is also of vital importance in the grant writing process to promote a new idea or concept to open the avenues of discovery. A clear and concise statement of purpose and plan for a research study increase the chance for funding a study to obtain new knowledge. There are several key ways scientists may effectively transmit findings

and ideas, including professional journals and scientific presentations, such as poster sessions, table clinics, round tables, or oral presentations at professional meetings. Continuing education courses are another mode of relaying information to user groups. Most states require professionals to stay current in their discipline in this way. In many cases, the media may also be a useful and effective tool for disseminating information. Internet-based information, including professional journals, government web sites, professional listserves, and consumer information, is a rapidly growing form of information dissemination.

It is the responsibility of the dental public health practitioner to be able to evaluate the quality of

new information from all of these sources using cultivated skills in critical thinking to determine the usefulness and applicability of the information to the practice setting. Staying abreast of current information contributes to the pursuit of lifelong learning and allows one to respond effectively and accurately to inquiries from patients, stakeholders, and the public. In addition, this enables the public health practitioner to provide the most current, appropriate care for their patient population, based on the latest scientific evidence. This is referred to as evidence-based practice.

EVIDENCE-BASED DENTISTRY

Chapter 2 stated that the goal of evidence-based practice is to facilitate timely translation of research findings into clinical and community practices that result in improved oral health. **Evidence-based dentistry (EBD)** is an approach to oral health care that requires the judicious integration of systematic assessments of clinically relevant scientific evidence relating to the patient's oral and medical condition and history, with the provider's clinical expertise and the patient's treatment needs and preferences.² The American Dental Association has defined EBD as a process that includes four components (Box 15-1):

1. Defining clinically relevant question(s).
2. Systematically conducting searches for all studies and databases, published or unpublished, that may help answer the question.

3. Translating the findings from systematic reviews for use by practitioners.
4. Assessing the health care outcomes that result from following the EBD process.²

It behooves the dental public health practitioner to apply EBD methods to aid in program planning and clinical care. Applying these methods helps ensure quality care and programs. Several professional organizations and government entities worldwide have developed centers for evidence-based practice. Among these resources are the Cochrane Oral Health Group, the University of York National Health Service Centre for Review and Dissemination, and the Center for Evidence-Based Dentistry at the Institute of Health Sciences at Oxford University. These sites also provide valuable links to other information on evidence-based practice. The resource section at the end of the chapter contains a list of useful sites.

DIFFUSION OF INNOVATIONS

Chapter 9 introduced the diffusion of innovations theory (Table 9-2 and Box 9-7). Health educators not only use the principles of this theory to select strategies for health education programs, but also for describing transfer of information from scientists or innovators at the point of discovery to the potential users of the information. A critical factor in the speed at which the diffusion of innovations (Fig. 15-1) or information occurs is



BOX 15-1 Evidence-Based Dentistry

Four components of evidence-based dentistry:

1. Defining clinically relevant question(s).
2. Systematically conducting searches for all studies and databases, published or unpublished, that may help to answer the question.
3. Translating the findings from systematic reviews for use by practitioners.
4. Assessing the health care outcomes that result from following the EBD process.

From American Dental Association Policy on Evidence-Based Dentistry. Available at: <http://www.ada.org/prof/resources/positions/statements/evidencebased.asp>. Accessed May, 2009.²

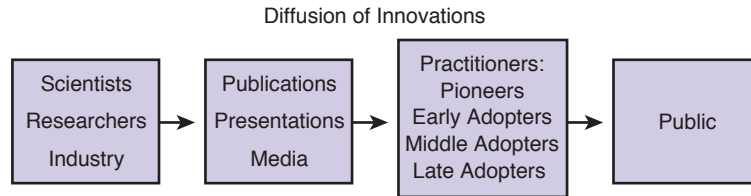


FIGURE 15-1 Diffusion of innovations. (From Becker MH. Factors affecting diffusion of innovations among health professionals. *Am J Public Health* 1970;60(2):294–304.)³

the scientist's ability to disseminate the information quickly and efficiently and the professional's vigilance in staying abreast of new evidence, ideas, and treatment modalities.

Scientists, researchers, and industry are primary sources of new information. The role of these entities is to investigate new technologies, modes of care delivery, techniques, and materials in terms of safety, effectiveness, and quality. In addition, they may evaluate current methodologies to determine continued effectiveness in light of new information. It is also their role to initiate the dissemination of the information through effective channels of scientific communication. Historically, the information was first made available to professional practitioners in the field.

The time lag that occurs between the disclosure of new knowledge and the use of this knowledge by health care professionals can deprive many citizens of the benefits of the information, sometimes for many years. Currently, more and more companies with a product to market are targeting the public directly through the use of the media in hopes that the public will receive the information sooner and will prompt providers to consider the product sooner. Although this is a marketing strategy, it also may shorten the time of diffusion (Fig. 15-2). In addition, it applies greater pressure to practitioners to stay

abreast of new information. Because the media does not always portray health information accurately, providers should be prepared to educate their patients.

As described in Chapter 9, not all adopters of innovation are created equal. Not all providers adopt or embrace new procedures, technology, or materials at the same rate. Adopters can be pioneers (innovators), early adopters, middle adopters (majority), or late adopters (laggards).³ Pioneers and early adopters are the first to hear of new innovations and the first to adopt them into practice. As a result, they become opinion leaders in the communication network in their respective field and, as such, are often looked to as highly credible sources of information. Middle and late adopters may rely on these opinion leaders for information or seek it out in other ways but, for various reasons, are not as quick to adopt the innovation into their practices. When the information is disseminated and available to practitioners, it becomes the role of the practitioner to access and assess the information. Although the Internet now provides much quicker and broader access to information for all levels of adopters and may speed up the diffusion of new ideas, it also adds new challenges in assessing the quality of available information.

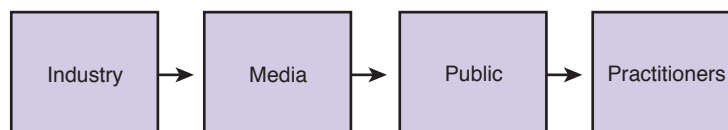


FIGURE 15-2 New path for diffusion of innovations.

ACCESSING INFORMATION

To provide evidence-based programs, it is important to be able to locate the latest information. Most students and public health practitioners are familiar with seeking out resources through a library catalog to obtain information on a topic of choice. Many health science libraries have reference librarians who can assist in locating information or generating a computer literature search for you. If the library does not have the journal or book in their collection, they can assist in requesting the information from another library. This may be time consuming and costly and not feasible for the provider who needs it quickly. However, this method is becoming dated with the accessibility of online resources.

Many sources of information are available at the touch of a finger. Certain sources and advantages and disadvantages of each are detailed in Table 15-1. With access to the Internet, a **literature search** of the medical, dental, and other literature databases worldwide can be quickly performed. An example is **MEDLINE** or **PubMed**, an English language bibliographic database that allows free Internet access through the National Library of Medicine. A perfect example of the diffusion of innovations is that new search engines and databases are appearing constantly and many professional journals

are becoming available online for immediate downloading without the delay of sending away for reprints from the author, publisher, or the nearest health sciences library.

In addition to professional journals and publications, the Internet provides access to a multitude of other sources of information, including funding agencies, foundations, census figures and immigration statistics, and oral health programs. In addition, information from most government agencies can be accessed, many of which have information and specific data about national efforts in your area of interest. These may include the Surgeon General's Report on Oral Health,⁴ Healthy People Objectives for the Nation,⁵ the National Center for Health Statistics—FastStats,⁶ the National Oral Health Surveillance System,⁷ the Centers for Disease Control and Prevention,⁸ or the World Health Organization.⁹

Many listserves can be found on the Internet where professionals dialogue on topics pertinent to their practice. These listserves allow professionals to ask questions of colleagues and experts about sources of information, successful programs, and funding opportunities. It also can provide the opportunity for partnering to build alliances for oral health promotion. A well-established professional listserv in dental public health is listed in the resource section.

TABLE 15-1 ADVANTAGES AND DISADVANTAGES OF SOURCES OF INFORMATION

SOURCE	ADVANTAGE/DISADVANTAGE
Newsletters	Current; not scientific
Journals	Current information; rigor and objectivity varies
Books	Foundational knowledge; dated information
Published empirical reports	Current information; rigor and objectivity varies
Advertisements	Biased information
Newspapers	Clue to public interest; subject to interpretation and bias
Popular magazines	Readable; subject to interpretation and bias
Internet	Accessible; no control over validity of information
Professional meetings	Current information; rigor and objectivity varies

The Internet facilitates accessing an overwhelming amount of information but, unfortunately, does not assess the quality of information available. That process still remains with the user.

ASSESSING INFORMATION

Evaluating the quality of information involves the ability to discriminate between high-quality, valid information and information that is not predicated on sound scientific principles. Learning to critically review information may take time and practice to develop, but it is essential to the practice of public health. Scientific information and the number of journals are compounding at alarming rates, making it virtually impossible for professionals to stay abreast of new information without strong skills in critical review. Professional education and competence includes the ability to evaluate the quality of information. How does a health care professional decide which information is useful, pertinent, valid, or of high quality? How does one go beyond textbooks to make those decisions on their own?

Textbooks provide strong foundational knowledge in a specific field. However, the nature of the publishing process can render much cutting-edge information obsolete by the time of publication. The time line for publishing a text can be 2 to 3 years, and the information may be several years old at submission. Professional journals may bring information to the reader sooner because they are published more frequently. Even so, the process of publishing the paper may take 6 months to 1 year before it is available. Presentations at scientific meetings may be made soon after results of a study or evaluation of a program take place, making this a more rapid form of information diffusion. Attendance at these meetings is an important part of being a professional and pursuing lifelong learning.

Assessing Written Information

Obviously, the source of information is an important factor in determining the quality

of information. Textbooks and quality journals undergo a process of **peer review**. This means the information has been reviewed, **juried**, or **refereed** by other scientists or experts in the field before it is accepted for publication. This is usually achieved by an anonymous method carried out by the publisher or editor and ensures the quality of the publication and the reputation of the journal and/or the professional society sponsoring the journal. This is a several step process, which explains the delay in the information being available to the public (Fig. 15-3). However, it is a necessary trade-off to assure the quality of the information disseminated. Although textbooks lend themselves well to the educational process, journals are a more common source of information for practicing professionals.

Journals are not all created equally. Not all journals are peer-reviewed or published with the goal of strong scientific integrity. To determine if a journal is peer-reviewed, check for a listing of the editorial board and read through the journal's author instructions. Does it mention a review process or ask that multiple copies of an article be submitted? Contacting the editor directly can also be useful. Journals may be sponsored by a learned society or scientific publisher, a professional organization, or a commercial publisher.¹⁰ Learned societies are formed for the purpose of disseminating scientific findings, and they maintain a strong emphasis on scientific rigor. Advertising is rarely included in the publications. Reputable scientific publishers also place a premium on scientific rigor. Journals from professional organizations are peer-reviewed in some manner; however, there may be bias toward the views of the organization and considerable advertising may be included to offset the cost of publishing. This may not compromise the quality of the information, but it is important to consider in the evaluation of the content. Many more commercial publishers, including dental-related industries, are producing journals for practitioners. A review process, if present, is not nearly as scientifically rigorous and frequently handled in-house. Articles may be solicited or written by staff writers. It is important to consider the level

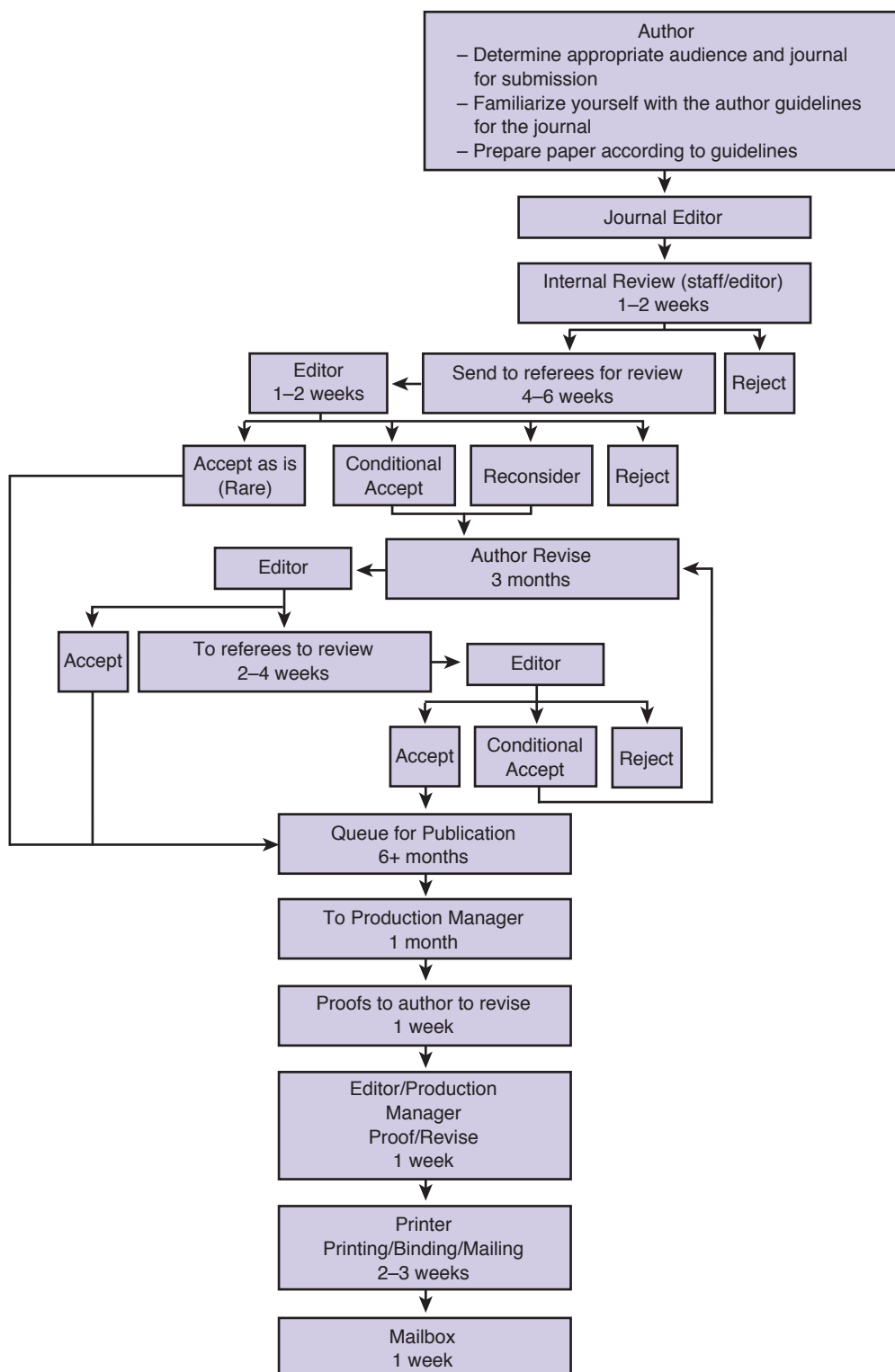


FIGURE 15-3 Steps to publishing a scientific article. (Recognition to Tomar S, ed., J Public Health Dent, for providing the information used for this timeline.)

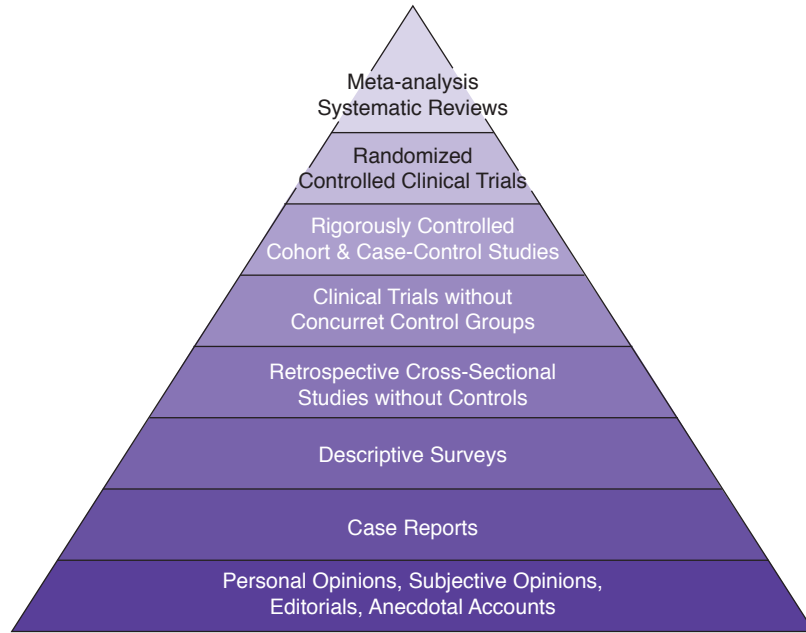


FIGURE 15-4 Levels of quality of scientific information from highest (apex) to lowest (base).

of quality of the information in the article before deciding how to use the information in practice (Fig. 15-4).

When a health care practitioner is experienced in a field of interest and becomes familiar with the available journals, the quality of a journal can be quickly determined. If the publication is determined to be a reputable source of information, a more specific review can be applied to the article of interest. Are the authors well known in their field? Are they affiliated with a research or academic institution? Was the study funded by a federal agency or well-respected foundation or by a commercial enterprise?

Next, the **abstract** is critiqued for an overview of the content. Does the **title** reflect the content of the article? Does the content offer new information or concepts that would be useful to your program? What information is presented and how well is it supported by other literature or studies and by the results presented in the article? It is important to determine how this new information expands knowledge, is congruent or incongruent with what is known, and

whether or not the conclusions presented are supported by the evidence. Keep in mind, causation cannot be determined by a single study, but must be developed over time, with multiple studies indicating a particular cause and effect. Claims of cause and effect must be considered with caution.

When the reader is satisfied that the source is reputable and the content of the article is of interest, it is time to read the entire article. Some practitioners prefer to read the **methodology** section first to determine if the methods employed are valid and reliable. Are there dental indices, survey instruments, or measurement tools presented that have not been previously used or tested? Are flaws in the sampling process evident? Are there flaws in the chosen research design that may influence the validity of the results? Research method and design have been addressed in earlier chapters.

If the methodology is acceptable and appropriate, the reader may continue with other sections. The **literature review** or introduction should clearly identify the problem and

provide an unbiased presentation of background information about the topic. The **references**, therefore, should be current and represent both sides of the issue.

In the **results** section, any statistical tests should be described and be appropriate for the data col-

lected. This was also addressed in more depth in Chapter 14. Are the results statistically significant or clinically significant? Could they be applied to any similar practice situation and to what extent? Is more information needed to assess the value of the results in relation to another practice?



BOX 15-2 Assessing Written Information Sources

Publication Quality

- Peer-review process, editorial board
- Professional organization, learned society, commercial publisher
- Current
- Authors well respected

Title and Abstract

- Title clear, reflects content, useful to your practice
- Abstract complete, concise, expands knowledge, conclusions supported, major findings reported

Introduction/Literature Review

- Problem clearly stated and developed
- Unbiased presentation of topic

Methodology

- Sample appropriate—size and selection
- Indices/measurement tool reliable, valid, sensitive, specific
- Research design
- Relevant or adaptable to your practice/program

Results

- Appropriate statistical analysis chosen
- Charts and graphs clear and described in text
- Statistically or clinically significant
- Applicable to practice

Discussion

- Conclusions warranted from results presented
- Limitations described
- Generalizable to other situations
- Other explanations for results

References

- Current
- Thorough
- Useful for further investigation
- Original source of information

When reviewing the **discussion** section, determine if the conclusions presented are supported by the results. Are the authors forthcoming about any potential limitations to the study? Can the results be generalized to other practice settings? Are there possible explanations for the stated outcomes other than those suggested by the authors? See Box 15-2 for a summary of items to consider when consulting written information.

A **critical review** of an article is not solely for the purpose of being critical of the research or the authors. It is to assess the level of quality of the information and how it may be used appropriately, if at all, in practice. Often, when first learning to review the literature, learners are focused so heavily on finding fault and criticizing that they neglect to consider how the information may provide some positive growth in the knowledge base of the field. Eventually, the pendulum swings back to a more neutral unbiased review. An unbiased critical review looks at both the positive and negative aspects of the information.

Assessing Internet Information

Techniques for assessing written scientific information have been available for some time, and each person may adapt them to their own personal style or preference. The explosion of Internet information and the type and amount of information available for both scientists and the lay public through that source requires some additional evaluation. Guides are now being developed for review of web sites and Internet material. Dalhousie University in Canada¹¹ has developed a list of six criteria for evaluating health information on the Internet: (i) credibility, (ii) content, (iii) disclosure, (iv) links, (v) design, and (vi) interactivity (Box 15-3). In addition to the criteria already mentioned for assessing written information, these criteria are useful for web sites in particular.

Assessing credibility includes considering the source of the information and its currency and relevance and whether it is subject to a review process. The content should be accu-



BOX 15-3 Assessing Health Information on the Internet

Credibility

- Source
- Currency
- Relevance
- Review process

Content

- Accuracy
- Disclaimer
- Completeness

Disclosure

- Purpose of site
- Data collection

Links

- External links provided

Design

- Navigation
- Logically organized

Interactivity

- Feedback
- Questions
- Accountable to users

Reprinted with permission from Evaluation of Health Information on the Internet. W.K. Kellogg Health Sciences Library. Dalhousie University, Halifax, Nova Scotia, Canada. Available at: <http://www.library.dal.ca/kellogg/internet/evaluate.htm>.¹¹

rate, complete, and provide a disclaimer. It is also important that users are informed about collection of any information about them and how that information will be used. Links are provided for additional high-quality sources for information on that topic, and the design should provide for easy navigation of the web site. The web site should also provide a way for users to interact and provide feedback and comments.

COMMUNICATING YOUR MESSAGE

It was mentioned that it is the role of the scientist to effectively communicate new information to other professionals or the public. What if you have a striking new idea or discovery about which you want to inform people? The best way to communicate the message may be in the form of a journal article or presenting at a professional meeting by means of a table clinic, poster session, oral presentation, or round table. You may want to provide a continuing education course for a local dental or dental hygiene society or other interested group. How will the presentation be organized? What is the best forum for presenting the message? All of these are considerations when communicating a message. This section will explore the various methods of communicating new information. There are many resources available for a more in-depth discussion of writing a research paper. Certain resources are listed at the end of this chapter. An important step for any author or presenter is to have a colleague(s) read, review, or listen to a presentation and provide feedback on content, style, and readability. This may help avoid many pitfalls, including grammar and spelling, especially those mistakes spell-checker does not catch!

Although this section focuses on a typical journal article, the principles are the same for submitting a case study, a review of the literature, or other informational article for publication.

Journal Articles

A standard journal article describing a new scientific development or program includes six sections, abstract, introduction or review of the literature, methodology, results, discussion, and references. This is not necessarily the order in which they are written, but the order in which they may appear in the published article. Preparing an article for publication has many similar considerations as the critical review of articles from other authors.

Before beginning the writing process, consider the audience that may be most appropriate

for the information. What professional journals might reach that audience? What are the style requirements for the publication(s)? Most publications publish instructions to authors at least once a year. Locate these instructions and follow them during the construction of the article. It will save considerable time reformatting.

LITERATURE REVIEW

The literature review, usually the first section written, begins with a thorough search of the available literature on the topic. This section is a review, synthesis, and evaluation of the current scientific knowledge on the subject of the report. It also points out where there may be gaps in the scientific knowledge. This process requires a base list of references, including those from MEDLINE or PubMed and other sources such as books, government agencies, and other official documents. For each pertinent reference located, the complete reference citation, including journal, author(s), volume number, pages, publisher and publisher location, and date of publication, should be documented. For web sites, include the uniform resource locator and the date accessed. Index cards are useful for this purpose. Each index card should include the complete citation and a short synopsis of the article. These can easily be sorted and arranged according to topic or format for the paper. In addition, there are several computer software reference programs available for use. These programs allow sorting and storing of references and article information.

When the information to be included is located, it is time to use skills in assessing the quality of the information and organizing it into a logical order. A working outline of the paper should include an introductory paragraph that states the purpose of the paper, program, or study. Following this statement of purpose, the analysis and synthesis of the information is presented in a specific manner, such as chronologically, geographically, by magnitude of results, or information supporting or refuting the concept. Subheadings may be useful for clarification of information. When the information is presented,

concluding comments can tie the information together and to the original premise of the study or program.

METHODOLOGY

Methodology describes the details of how the study was performed or how the program was administered. This section should answer the questions of who, what, where, how, and why. It also should be in enough detail to allow others to evaluate the study or program and be able to replicate it or adapt it for their needs. This section details the research design, including sampling technique, procedures performed, data collection instrument(s) and criteria, process of evaluation, and the rationale for the procedures used.

RESULTS

The results section describes the analyses of the data collected or outcome of the evaluation procedures, including the statistical tests performed. Data also may be presented in table or graph form, together with the text for clarification and emphasis of important findings. It is important at this point to refrain from interpreting the results and discussing the implications, as that is reserved for the discussion section of the paper.

DISCUSSION

The discussion section provides the reader with the author's thoughts on what the results mean and the significance of the results to the profession. It discusses findings that agree or disagree with the current literature, the interpretation of the findings, and the significance of the results. Opinions can be expressed, if they can be supported by the results. Any limitations in the study or applicability or generalization of the results to other settings should be included. A concise summary with conclusions should highlight the major findings and their significance. Suggested areas of further study are also a beneficial addition.

REFERENCES

The reference section is a fluid portion of the paper. The list of references will grow as the paper or program develops, new information becomes available, and references are gleaned from information read while preparing the paper. From the beginning of the process, they should be complete and reflect the most current research in the field. They should be generated from the **original source** or author of the information. This means that the reference quoted should be the original study or article and not from a **secondary source** that has quoted the material in a later publication. Quoting the secondary source may not accurately reflect the intent of the original author and may result in inaccuracies if the original intent was taken out of context or misquoted by the second author.

To avoid plagiarism, credit is given to the original author for direct quotes, paraphrased ideas, factual statements, and information that is not common knowledge. Also avoid "selective referencing" in which only references that support a single opinion on a subject are included. An unbiased presentation of opposing views increases credibility of an author.

Placing the reference numbers in the text in a way that clarifies the source of the information and yet does not disrupt the flow of the paper for the reader is an important consideration. Too many references in the text become unreadable, whereas inappropriate location in the text makes it difficult for the reader to determine the source of the information. Check the style requirements for the publisher to whom the paper will be submitted and follow them closely. This includes material found both in written sources and on the Internet. While constructing the paper, it is convenient to use the author's name and date of publication in parentheses in the text, rather than a number of a reference. This allows easier revision and reorganization or addition of references as the writing process develops. The final numbers in the text and a bibliographic list can be easily generated as a last step in the process.

ABSTRACT AND TITLE

The abstract is usually written last because it is a concise summary of the entire paper. Again, refer to the style requirements of the publisher for proper format of the abstract. An abstract is usually 200 to 300 words long and includes purpose, methodology, results, and conclusions. It is a vehicle for the reader to determine if the content of the paper is of relevance to their practice and whether or not to read the entire text. As such, clarity and brevity are the keys to getting the point across in a limited space.

You most likely used the abstracts and titles of other articles in your literature search to determine the usefulness of articles for your own paper.

The title will be indexed and used as a guide or screening tool by readers and other researchers. Use words that accurately reflect the nature of the information. Avoid using unnecessary words that add length and not clarity. Many publications have a limit on the number of characters allowed in the title.

Oral Presentations

An **oral presentation** is another forum for communicating a message. This forum works well for describing a program or presenting research findings. Most professional associations have annual meetings at which the diffusion of new information is a core expectation. A common method of disseminating the information is to have speakers present their work in an oral format, including lectures, symposiums, or panel discussions. Oral presentations often follow a format similar to scientific journal articles and should include a statement of the problem or purpose, a brief review of the literature, the methodology employed, results, and a discussion of the relevance of the findings. In this format, presentations must closely follow a time schedule. The length of time allowed for each presenter is designated by the meeting planner, commonly between 10 and 20 minutes, with a short question-and-answer period at the end. This format does not usually allow audience interaction.

This may be one of the most difficult delivery approaches because of the inflexibility in time, difficulty in determining audience characteristics, and performance in front of an audience. If some form of media is used, the size and layout of the room and familiarity with equipment available will determine appropriate use of audiovisuals. If a speaker is not experienced in presenting in front of an audience, then practicing in front of colleagues to get feedback on style, content, and pace is advised. If there is to be a question-and-answer period, it is important to anticipate what questions may be asked and to provide concise responses to allow several people to be able to participate. If one is unable to answer a question, do not attempt to make up an answer. Ask the participant to write the question and their contact information on a piece of paper. The information and response can be communicated later. Another member of the audience may have the information and wish to respond. The honesty of admitting you do not have the information and the offer to follow up is much more refreshing than an attempted response that, in its own way, clearly indicates you do not know.

Table Clinics

A **table clinic** is effective for demonstrating a new clinical technique or product. This is a visual format that allows hands-on demonstrations on a tabletop and open discussion with the viewer. A short presentation of the concept or procedure is followed by audience questions and interaction. The presentation is repeated frequently to allow several small groups to attend. Space may be limited to six to eight people or the number who can easily gather around the table area. This format allows a great deal of interaction with the audience.

Attractiveness of the display is important in generating interest in your message. One may use video, slides, or computer-generated visuals. A brief handout or samples of the new product are often expected. Some organizations sponsor table clinic competitions in which the



FIGURE 15-5 How Does Oral Bisphosphonate Drug Therapy Affect a Clinical Treatment Plan? Oregon Dental Conference Table Clinic Competition, First Place, May 2009. American Dental Association National Competition, October, 2009.

presentation is viewed by a group of judges and prizes are awarded (Fig. 15-5). Use techniques described in Chapter 10 for suggestions on how to create an attractive visual display.

Scientific or Programmatic Posters

A **poster** session format is becoming more popular at professional meetings, as it allows for

a greater variety of information to be displayed in a smaller time frame and space. Usually lasting 2 to 3 hours, a poster session allows the participants to selectively view topics in which they are interested and allows open discussion with the presenter. This style of presentation promotes communication among professionals who may have similar interests. The presentation is visual in nature and may use photos, graphs, or bullet lists, but also should follow the format of abstract, methodology, results, summary, and conclusion. Again, follow suggestions in Chapter 10 for creating an effective visual effect.

Be prepared to answer questions on the topic of the presentation. A nice touch would be to offer a short handout or abstract that reinforces the material. Include contact information to allow viewers to contact the presenter later if they have other questions. This promotes collegiality with other professionals who may have similar interests and may lead to future projects, job opportunities, or grant proposals.

Again, some organizations sponsor poster competitions in which the presenter has a time limit to make a formal presentation to a group of judges and to respond to their questions (Fig. 15-6).

Round Table Discussions

A **round table** is yet another way to disseminate information and receive feedback on a topic, a study design, or new program. This is an interactive format and an excellent way to generate interest in a new theory, political agenda, or other topic in which you would like to brainstorm or build coalitions.

Skills in small group facilitation are extremely useful for this format to be productive. Conversations can easily divert to other subjects and decrease the effectiveness of this group process. Tips include having a set agenda with a preliminary introduction of all of the participants, a short presentation of the topic to center the discussion, and a handout with discussion points and contact information for all participants after the meeting for participants to continue the dialogue if they desire. This format

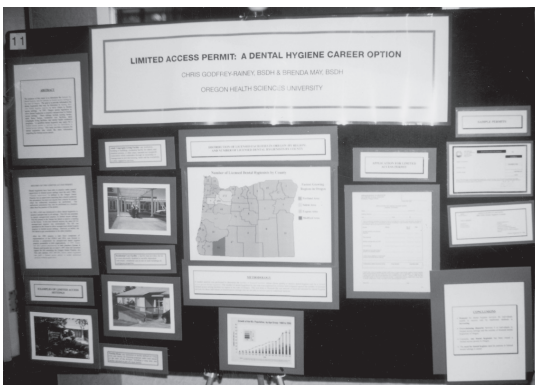


FIGURE 15-6 Limited Access Permit: A Dental Hygiene Career Option. San Diego, CA: American Dental Hygienists' Association Student Poster Competition (4th place), June 1999.

is limited in attendance to the number of people who can be accommodated at the table, usually eight to ten people. Audiovisuals are only limited by the time frame allowed and room accommodations.

Summary

Scientific communication is a critical component of public health practice. Whether you are the grant writer for the development of a new idea, a scientist, a program administrator imparting information about a program or discovery, or the practicing professional trying to stay abreast of new information pertinent to your practice, the dissemination of information is important. Accessing and assessing the information pertinent to the practice of public health is a skill that requires practice, diligence, and a desire to be a continual learner. There are many ways to access information. However, the Internet is fast becoming the preferred mode because of its efficiency and the amount of information available. Efficiently assessing the quality and usefulness of that information is an invaluable skill. Being able to express your ideas, opinions, and concepts in a concise, clear manner using any one of many different formats is another skill that takes creativity and practice.

Learning Activities

1. Locate form and style recommendations from various journals and compare and contrast them.
2. Create a poster, table clinic, or round table discussion format centered on a topic of interest (group or individual).
3. Write a scientific paper based on your own research or community project (group or individual).
4. Perform an Internet- or Web-based literature search on a topic of choice (individual).
5. Choose an article to critically review and share with the class (group or individual).

6. Write a review of the literature on a topic of choice, comparing and contrasting several articles, assessing quality, and deriving conclusions based on what you read (individual or group).
7. Establish a weekly journal review group, rotating leadership of the discussion, to develop small group facilitation and leadership skills.
8. Visit a dental consumer web site and evaluate the quality of information based on credibility, content, disclosure, links, design, and interactivity.
9. Select an EBD web site and evaluate the site based on credibility, content, disclosure, links, design, and interactivity.
10. Identify a public health issue in the popular media and evaluate the content and appropriateness of the information.
11. Develop a web site as a resource for a specific oral health topic.

Resources

- AAPHD listserv for professionals in dental public health. Available at: <http://www.aaphd.org>. (Internet discussion group related to dental public health topics. Access AAPHD web site to join the listserv)
- ADHA. Writing Research Papers. *J Dent Hyg* 1996;70(1):10–13
- Alley M. The Craft of Scientific Presentations: Critical Steps to Succeed and Critical Errors to Avoid. New York: Springer-Verlag, December 13, 2002
- American Association of Public Health Dentistry (AAPHD). Available at: <http://www.aaphd.org>
- Briscoe MH. Preparing Scientific Illustrations: A Guide to Better Posters, Presentations, and Publications. 2nd ed. New York: Springer-Verlag, 1996
- Center for Evidence-Based Dentistry, Institute of Health Sciences, Oxford University. Available at: <http://www.cebd.org>
- Cochrane Oral Health Group. Available at: <http://www.ohg.cochrane.org>

University of York, National Health Service Centre for Reviews and Dissemination (CRD). Available at: http://www.york.ac.uk/inst/crd/about_us.htm

Forrest JL, Miller SA, Overman PR, Newman MG. Evidence-Based Decision Making: A Translational Guide for Dental Professionals. Baltimore: Lippincott, Williams & Wilkins, 2008

Lester JD. Writing Research Papers: A Complete Guide. MLA Update. 10th ed. New York, NY: Longman Publishing, 2003

National Library of Medicine. Available at: <http://www.ncbi.nlm.nih.gov/pubmed>

Agency for Healthcare Research and Quality. Available at: <http://www.ahrq.gov>

Evidence-based Practice Guidelines: www.usc.edu/hsc/dental/dhnet/online/ebp.html

4. The most current source of valid and reliable scientific information is most likely found:
 - a. in a textbook.
 - b. in a journal article.
 - c. at a professional meeting.
 - d. on the Internet.
 - e. in an advertisement.
5. The highest quality of scientific information is based on:
 - a. case reports.
 - b. retrospective cross-sectional studies without controls.
 - c. anecdotal accounts.
 - d. clinical trials with control groups.
 - e. clinical trials without control groups.

Review Questions

1. Which method of scientific communication would be MOST appropriate for demonstrating a new method of fluoride application?
 - a. Oral presentation
 - b. Round table discussion
 - c. Poster presentation
 - d. Table clinic
 - e. Journal article
2. Which of the following is NOT one of four components of EBD as defined by the American Dental Association?
 - a. Systematic literature review
 - b. Defining a question
 - c. Translating findings for use
 - d. Assessing health outcomes
 - e. Presenting findings at a professional meeting
3. Opinion leaders in the diffusion of innovations theory are most likely:
 - a. early adopters.
 - b. middle adopters.
 - c. late adopters.
 - d. nonadopters.
 - e. the general public.

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6. National Center for Health Statistics—FastStats. Available at: <http://www.cdc.gov/nchs/fastats>.
7. National Oral Health Surveillance System. Available at: <http://www.cdc.gov/nohss>.
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ETHICS AND THE LAW IN PUBLIC HEALTH PRACTICE

MODULE

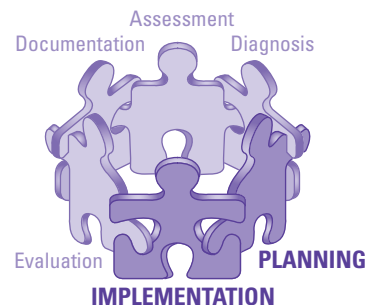
5

Ethical Principles

Objectives

After studying this chapter, and completing the study questions and activities, the learner will be able to:

- Describe the characteristics of a profession.
- Identify responsibilities that contribute to professional behavior and attitude.
- Identify clinical professional responsibilities, focusing on patient care and patient–operator interactions.
- Understand the underlying ethical theories that are the foundation of ethical principles.
- Identify and describe the ethical principles guiding ethical behavior and decision making.
- Identify the purpose of a professional code of ethics.
- Describe the concept of the common good.
- Describe the concepts of cultural competence, cultural sensitivity, and cultural knowledge.
- Define an ethical dilemma.
- Describe the steps outlined in the ethical dilemma resolution framework.
- Apply the ethical dilemma resolution framework model to ethical dilemmas encountered in community settings.



KEY TERMS

Autonomy

Beneficence

Bioethics

Code of ethics

Common good

Confidentiality

Cultural competence

Cultural knowledge

Cultural sensitivity

Deontological ethics

Ethical decision framework

Ethical dilemma

Ethics

Fidelity

Health Insurance Portability and

Accountability Act (HIPAA)

Institutional Review Boards (IRB)

Justice

Moral values

Nonmaleficence

Profession

Professional responsibility

Professionalism

Social justice

Utilitarian ethics

Veracity

Virtue ethics

See Appendix 3 for the ADEA competencies addressed in this chapter.¹

Introduction

Ethical principles are the core elements characteristic of dental professionals and professional behaviors. Professional and personal communications, actions, and decisions are guided by a profession's **code of ethics**. Codes of ethics encourage oral health providers to commit to

contribute to the well-being of patients and the communities in which they practice and live. The specialized expertise and knowledge of a dental provider allows them to impact a community's oral health status and well-being. With the responsibility of contributing to attaining and maintaining the oral health of the citizens of a community, come challenges and dilemmas. It

is useful to be familiar with an ethical decision-making framework that can address the ethical dilemmas encountered by practitioners in their many roles and responsibilities—in their practice, in their community, and in their professional associations.

PROFESSIONALISM AND PROFESSIONAL RESPONSIBILITY

A special relationship exists between a provider and patient. The patient trusts that the provider will demonstrate professional judgment and behavior. Dentists, dental hygienists, and dental assistants are professionals and members of a **profession**. A profession is an occupation with a specific set of characteristics; one that is self-regulated through systematic training and collegial discipline, with a foundation in technical, specialized knowledge requiring advanced education and skill. Additional characteristics are a service focus and code of ethics. **Professionalism** is defined as a set of values, attitudes, and behaviors that place the client's self-interest before the self-interest of the professional.

A dental professional is required to enroll in a rigorous academic program that assesses skills, knowledge, critical thinking, and judgment. In addition to the academic program required, to obtain a license the professional must successfully complete specific written and clinical examinations. There is a unique scope of practice for each member of the dental team. Once an individual is granted a license, that provider joins a profession that must demonstrate attitude and a set of behaviors that places the patient's interest and well-being as a priority. A code of ethics, which is drafted and approved by peers within a professional organization such as the American Dental Association (ADA) and American Dental Hygienists' Association (ADHA), provides a framework for the dental provider's actions and decision making.

An individual who identifies himself or herself as a professional must also satisfy certain responsibilities. A critical **professional responsibility** is to remain current in scientific and clinical knowledge that will assist the practitioner in

making evidence-based decisions. This responsibility is encompassed in the concept of being a lifelong learner and seeking to continue one's professional education throughout a career. There is also a responsibility to demonstrate a commitment to professional ethics and ethics-based decision making, which is founded on the expectation that professionals place patient well-being as a priority. The oral health care of patients by dental providers also serves the needs of society. Oral health and its relationship to general health, individual comfort, and personal self-worth and aesthetics are important to society. A society in poor oral health is unhealthy and unable to contribute.

Each element of professionalism reinforces and supports the others. There are also clinical elements to professionalism. The following traits can be considered clinical aspects of professionalism and professional responsibility:

- **Suspension of self-interest:** The patient's welfare and the welfare of the community take priority.
- **Honesty and integrity:** These qualities are important in the provider–patient relationship because of the trust required when sharing health information. These qualities are also fundamental in relationships with dental colleagues, third-party payers, other health and allied health professionals, and students.
- **Technical competence:** Patients must be assured that the provider meets high standards of care. Members of the dental or medical team must be confident that each member of the team is committed to excellence in all aspects of assessment, treatment, and evaluation.
- **Accountability:** A licensed professional is responsible to appropriately apply certain skills and knowledge, according to specific standards dictated by state laws and dental practice acts. The authority to provide specific services carries with it a responsibility to be accountable to patients, employers, government agencies, insurers, and society. This refers to the ability to answer for one's actions.

- **Communication:** Clear communication skills, which demonstrate cultural sensitivity and competence, are necessary to appropriately interact with patients. All patients must be treated with respect and dignity. Effective listening enhances respect and communication. A dental provider must be attentive, seek understanding, and show respect.
- **Tolerance:** This responsibility addresses the acceptance of all individuals and the qualities and characteristics they bring to the workplace or the provider–patient relationship.

PRINCIPLES OF ETHICS

A hallmark of a health profession is its use of ethical principles to guide decisions about patient interactions and care. All oral health care providers make clinical decisions using evidence-based information. In oral health care situations, the dental provider and patient have similar goals, to either attain or maintain optimum oral health. The provider uses knowledge, experience, and judgment and considers the needs of the patient in making treatment recommendations. Together with the patient, treatment decisions are made and implemented by the provider. **Ethics** concerns the standard of behavior and the concept of right and wrong. **Bioethics** is the discipline related to the ethical implications of biological research methods and results.

Practitioners are faced with dilemmas in their daily interactions with patients and colleagues, whether in the small business climate of a private practice or in more complex organizations, such as a public health clinic or community-based health program. The resolution of a dilemma is guided by ethical principles, professional responsibilities, and moral values. **Moral values**, influenced by family, religion, culture, and society, contribute to ethical conduct. Health professionals must not rely on their own value system however; instead, they should use ethical principles and professional codes to assist them.

A brief review of ethical theories and principles provides the foundation necessary to assist the practitioner in resolving frequently encoun-

tered issues and dilemmas. Ethical principles frequently cited in health care settings are based on ethical theory. Ethical theory attempts to provide a general set of considerations for moral behavior. Three major ethical theories are described. The first is **Utilitarian ethics**, proposed by John Stuart Mill, a 19th-century English philosopher, which suggests that the rightness of an act is measured by the outcome. What makes an action correct or incorrect is the good or evil that results, not the act alone. Utilitarian ethics suggests that the end justifies the means. Utilitarian ethics approaches an issue with a belief that the action or actions should produce the greatest good for the greatest number. Community water fluoridation, in addition to being a significant public health measure, is an example of utilitarianism in dental public health. This action, which reduces caries rates, is available to all members of a community at a low cost. Access to community water fluoridation satisfies the utilitarian's requirement to produce benefits for the largest number.

A second ethical theory, **Deontological ethics**, was proposed by Immanuel Kant, an 18th-century German philosopher. Deontology is derived from the Greek word *deon*, meaning duty. A deontologist suggests that an action is right when it satisfies an obligation or duty. A decision is not viewed based on the potential consequences, but rather a sense of duty. A dental provider, who is required by law to report suspected cases of child abuse, fulfills that decision because of a sense of duty. If the dental provider is aware that a child is at risk, the duty overrides any personal concern about losing a friend, colleague, or patient when the duty is fulfilled. Deontologists also suggest that performance of acts in the past creates obligations in the present. For example, if one has a contractual promise, one is bound by the terms of the contract.

A third ethical theory is **Virtue ethics**. Aristotle and Plato, fourth century BC Greek philosophers, were proponents of virtue ethics. This theory is based on the concept of the moral, virtuous, health care provider striving for excellence. This theory is viewed in terms of personal qualities, such as honesty, fidelity, wisdom, and self-restraint.

ETHICS IN HEALTH CARE

Ethics is a major branch of philosophy that guides in determining what is right and wrong. Bioethics is the philosophical study of ethical controversies stemming from advances in biology and medicine. A recent topic of discussion has been stem cell research as bioethicists focus on the ethical questions that occur in the areas of life sciences, biotechnology, medicine, politics, law, and theology.

Ethical principles important to the health care environment are as follows:

- Beneficence
- Autonomy
- Veracity
- Justice
- Nonmaleficence
- Fidelity
- Confidentiality

These principles are a guide to conduct. Each principle can be applied to the professional interactions of the dental provider with patients, colleagues, health care providers, and community members.

Beneficence advocates providing benefits, preventing harm or evil, and promoting good. This suggests that the health care professional must, through their actions and reactions, seek to “do good” for the patient. The dental provider who develops and implements a smoking cessation program at a local church or community center is promoting good oral health. Educating clients about tobacco and tobacco cessation strategies uses the skills and knowledge of the dental provider.

Autonomy flows from the concept of respect for individuals. All individuals have the right to self-determination, allowing that individual to decide on a course of action as it relates to their health care. A health care provider demonstrates respect for a patient’s autonomy in all interactions with the individual. An oral health care provider keeps the patient informed during assessment, diagnosis, treatment planning, and treatment. Informing a patient of the outcomes allows the patient to make informed decisions.

Obtaining informed consent from a patient prior to providing treatment is a structured method of providing information about their status in a comprehensive and understandable manner. The informed consent process allows the practitioner to explain a procedure, the need for the procedure, alternatives, and risks. This process also allows the patient to ask questions and have their questions answered. Each step in the process contributes to a patient’s understanding and their ability to make a decision about their health status.

Veracity is telling the truth, honesty, and integrity. This principle is important in many aspects of oral health care, primarily in the area of written and oral communication. Health care providers are expected to be truthful in their interactions with patients. If harm or an unanticipated, untoward incident occurs, the provider should communicate clearly and accurately to the patient or the person responsible for the patient. Dental professionals must also demonstrate integrity in the business aspect of oral health care delivery. Altering records, committing insurance fraud, or purposefully failing to correctly document in a patient record are examples of dishonesty.

Justice focuses on fairness and equality. Individuals are treated justly when they are given what they are owed, deserve, or can legitimately claim. It can also be described as fair equality of opportunity. All patients should be treated fairly and equally. Justice issues are important in oral health care delivery on many levels. All patients receive the same quality of care, whether as a privately insured patient or a subsidized patient. Justice also impacts decisions about community-based programs and the distribution of services. Dental professionals whose interests are in serving the needs of a community seek to ensure that services, preventive therapies, oral health education, and other efforts are equitably distributed to all those individuals who would benefit. Social justice also describes the concept of fairness in distribution of resources. Social justice, in view of health care and oral health care, suggests addressing unmet needs and taking actions to improve and increase access to services to

meet those needs. **Social justice** is frequently cited in discussions about access, financing, and delivery of oral health care in the United States. The significant number of uninsured citizens and inability for specific socioeconomic, ethnic, or racial groups to obtain care raises the question of the role of the dental professional and dental organizations in addressing unmet needs. The provision of oral health care services suffers because of the incorrect belief that it is less essential than other basic health needs. In addition unfounded fears of competition, cost, loss of authority, and quality of care contribute to lack of an appropriate response to meet the needs of underserved populations. Educating toward a social justice minded provider is one strategy that can influence students and practitioners in the dental professions. The strategies are simple and include the following:

- Raising consciousness by educating future practitioners, practitioners, and other health professionals about the extent of unmet dental needs in our society and how the burden falls on the most vulnerable.
- Engage in service. This can begin in education as part of service learning, but can also be a consideration for continuing education credit, professional membership, and relicensure. State dental licensing boards and professional associations could require documentation of community-based service for license renewal and/or membership, supporting the ethical justice concept.
- Encourage creative options. Students and practitioners should know that social justice can be pursued through initiatives at the local community level, beyond formal education experiences.
- Acknowledge limits. Oral health professionals must strive to increase access, contain costs, and maintain quality. Absolute equality may not be a goal, but rather provision of adequate health care meets a social justice approach.

Nonmaleficence requires the oral health care provider to avoid harming the patient; “above all, do no harm.” Dental professionals consistently take steps to prevent patient harm. Sterilization

of instruments, disinfection of a unit, and the use of universal precautions are examples of a provider taking steps to prevent patient harm. By their actions, dental providers are “doing good.” The operators, using their skill and knowledge, strive to never inflict harm, to prevent harm if able, and to remove or reduce opportunities for harm (e.g., the accurate recording of a patient’s health history). An up-to-date, accurate health history, for example, assists the provider from inflicting harm by identifying a local anesthetic allergy or preventing the incorrect anesthesia from being administered.

Fidelity is the requirement to keep implied or explicit promises. It is faithfulness to duty and obligation. The dental provider who promises to assist a local high school district in educating the students about the value of mouth guard use during athletic activities is expected to keep that promise. There are other responsibilities inherent in fidelity; fidelity includes a broader range of responsibilities than keeping a promise: (i) The responsibility to maintain confidentiality, which is implied by the relationship between the provider and patient when a health history is recorded. The patient assumes the provider will keep the information confidential unless appropriate steps are taken to acquire the patient’s permission to share the information. (ii) The responsibility of professional competence. If specific services are provided, the dental provider must have a certain level of knowledge, judgment, and skills that meet acceptable practice standards. The principle of fidelity supports the provider–patient relationship. Other responsibilities include keeping contractual agreements and never abandoning the patient prior to completion of treatment.

Confidentiality obligates the provider to keep all information about a patient private and to not share the information with a third party without consent. Confidentiality has its foundation in trust. The importance of confidentiality is identified in the Hippocratic Oath, which states, “What I may see or hear in or outside the course of treatment ... which on no account may be spread abroad, I will keep to myself, holding such things shameful to speak about.” This principle of confidentiality respects the patient’s privacy.

Thus, information about patients is not discussed with family members or friends. Permission must be granted prior to sharing health information with another party. There are exceptions to maintaining patient confidentiality. For example, there are legal requirements in certain situations to report specific infectious diseases, such as sexually transmitted diseases. In this instance, the individual's right to privacy is balanced against the need to protect the public good.

ETHICALLY-BASED COMMUNITY-TARGETED RESEARCH

Community-based research takes place in community settings that can have a variety of descriptions. A community may be defined by a geographic border, economics, language, religion, tribal or other affiliations. An ethically-based research project should involve community members in the design and implementation of research projects. All research has as its purpose to “do no harm” to the community member involved. **Institutional Review Boards (IRB)**, which consist of statisticians, researchers, and community advocates review the protocols to determine that the process is ethical and protects the rights of the participants. An IRB may also be called an independent ethics committee or ethical review board. These committees are designated to review, approve, and monitor biomedical and behavioral research that involves humans as research subjects. On July 12, 1974 the National Research Act (Pub. L. 93-348) was signed into law creating the National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research. This commission was charged with identifying the basic ethical principles that are the foundation for conducting research. The Commission, using the Belmont Report as a resource identified three primary principles, respect for persons, beneficence, and justice. Based on the principles, research protocols are required to include informed consent, to allow subjects to choose what shall or shall not happen, appropriate disclosure of sufficient information; comprehension by subjects and voluntariness.

Research protocols require review by an IRB, which includes protocols to minimize risk to individuals as well as informed consent procedures. However, there remains a concern that population-based research must also consider the collective risks to members of a specific group. Additionally, researchers must work with targeted communities to maximize benefits involved with the research. The American Academy of Pediatrics, Committee on Native American Child Health and Committee on Community Health Services² developed a policy statement focusing on Ethical Considerations in Research with Socially Identifiable Populations. The policy identified two general risks to identifiable populations, external risks and intracommunity risks. The following is a summary:

- External risks that may result in unintended harms that impact on economic, social, legal, and political life within a community.
- Economic risks may include employment or insurance discrimination, for example, on the basis of genetic information obtained. Other examples include significant domestic violence, or communicable diseases which may result in businesses refusing to remain in a particular community.
- Social risks may include social stigmatization if teen pregnancy, youth violence or drug abuse are reported, and support common misconceptions or stereotypes.
- Legal and political risks are subject to scrutiny because in the United States, American Indian and Alaska Native persons share special social and political status because of their ancestry.
- Research findings that are innocuous to some communities are threatening to others.
- Intracommunity risks include highly localized harms that may not be considered when IRB's review research. Outside involvement in local communities, although intended to be beneficial, can be disruptive to social order and relationships. There are local community members on some university-based IRB committees, but for those communities geographically removed, membership on an IRB may be nonexistent. IRBs require individual consent,

but some communities require collective consensus and assent that impact on an entire community. For example, the University of Washington requires documentation of appropriate letters of support from the tribal representatives.

The following principles should guide the development of research projects involving collaboration between researchers and community partners, with a special sensitivity to the needs of socially identifiable populations as well:

- Community partners should be involved at the earliest stages of the project, helping to define research objectives and having input into how the project will be organized. Potential benefits should be clearly articulated.
- Research participants should be considered partners not subjects.
- Community partners should have real influence on project direction—that is, enough leverage to ensure that the original goals, mission, and methods of the project are followed.
- Research processes and outcomes should benefit the community. Community members should be hired and trained whenever possible and appropriate, and the research should help build and enhance community assets.
- Community members should be part of the analysis and interpretation of data and should have input into how the results are distributed. Community members should be the first to be informed of study results. This does not imply censorship of data or of publication, but rather the opportunity to make clear the community's views about the interpretation prior to final publication. Community members may be consulted for proper methods of publishing and disseminating data.
- If a potential exists that results could be damaging to a particular community, research should keep the community anonymous when publishing or presenting results.
- Human research protection programs and IRBs should utilize appropriate options provided with the federal regulations (45 CFR 46) to guarantee proper representation as part of the ethical review process.

- Productive partnerships between researchers and community members should be encouraged to last beyond the life of the project. This will make it more likely that research findings will be incorporated into ongoing community programs and therefore provide the greatest possible benefit to the community from research.
- Community members should be empowered to initiate their own research projects, which address needs they identify themselves.

PROTECTING PRIVACY IN COMMUNITY-BASED SETTINGS

The individual treated at community-based clinics must be guaranteed the same protections as those patients treated in private practice settings. The increasing use of electronic medical and dental records increases the potential for individuals to access, use, and disclose sensitive personal data. Protecting privacy is a long-standing tradition among health care providers and public health practitioners. However, in the past legal protections in the federal, state, tribal, or local levels were frequently inconsistently applied and inadequate. All dental and health care providers receive training concerning the **Health Insurance Portability and Accountability Act (HIPAA)**.³ HIPAA was enacted by the U.S. Congress in 1996 and requires the establishment of national standards for electronic health care transactions and national identifiers for providers, health insurance plans, and employers. The HIPAA Privacy Rule provides national standards for protecting the privacy of health information. The guidelines regulate how certain entities use and disclose individually identifiable health information, called protected health information (PHI). PHI is individually identifiable health information that is transmitted or maintained in any form or medium, for example, electronic, paper, or oral. Some of the provisions of the Privacy Rule include the following:

- Giving patients more control over their health information.

- Setting boundaries on the use and release of health records.
- Establishing safeguards that health care providers must achieve to protect the privacy of health information.
- Holding violators accountable with civil and criminal penalties if they violate a patient's rights.
- Striking a balance when public health responsibilities support disclosure of certain forms of data.
- Enabling patients to make informed decisions about how individual health information should be used and what disclosures of their information have been made.
- Limiting release of information to the minimum reasonably needed.
- Giving patients a right to a copy of their health records and request corrections.
- Empowering individuals to control certain uses and disclosures of their health information.

Public health practice and research, including public health activities such as program operations, public health surveillance, program evaluation, terrorism preparedness, outbreak investigations, and public health research use PHI to identify, monitor, and respond to disease, death, and disability in population groups. Community-based clinics must meet their obligations while continuing to respect the privacy of their clients. Administrators and staff should be familiar with their obligations. The Privacy Rule enforced by the Office for Civil Rights (OCR) should be reviewed on a regular basis. There are instances in which PHI disclosure is permitted without authorization. Disclosure can occur without authorization if

- required by law, federal, tribal, state, or local.
- public health such as public health surveillance, investigations, and interventions.
- health research if certain conditions are met.
- abuse, neglect, or domestic violence.
- law enforcement, for example, a court order or subpoena.
- judicial and administrative proceedings.
- cadaveric organ, eye, or tissue donation purposes.
- oversight purposes.
- worker's compensation.

A valid authorization is required for any use or disclosure of PHI that is not required or otherwise permitted without authorization as previously listed. The authorizations must

- specifically identify the PHI to be used or disclosed.
- provide the names of persons or organizations, or classes of persons or organizations who will receive, use, or disclose the PHI.
- state the purpose for each request.
- notify individuals of their right to refuse to sign the authorization without negative consequences to treatment, payment, or health plan enrollment or benefit eligibility.
- be signed and dated by the individual or the individual's personal representative.
- be written in plain language.
- include an expiration date of the event.
- notify the individual of the right to revoke the authorization at any time in writing, how to exercise the right and applicable exceptions.
- explain the potential for the information to be subject to redisclosure by the recipient and no longer protected by the privacy rule.

CODE OF ETHICS

Oral health care providers are guided in their decisions by their personal values. These values are influenced by education, personal and professional experiences, and religious and cultural background. A code of ethics is important to all health professions. A code of ethics is a formalized description of principles that govern the behavior of a profession's members and provide a framework for decision making. The ADA's Principles of Ethics and Code of Professional Conduct⁴ are based on five ethical principles and provide guidance and direction to dentists. The Code consists of statements as well as advisory opinions to address decision-making, business practices, and professional interactions. The American Dental Hygienists' Association Code of Ethics⁵ provides guidance to its members

for appropriate behaviors in various situations and assists in monitoring the profession. The ADHA code is based on core beliefs and ethical principles and outlines the dental hygienist's responsibilities on various levels, as a provider, colleague, professional, and researcher. As new issues emerge that must be addressed, the codes are edited or expanded to assist practitioners to address current issues. The codes of ethics for dental professionals highlight common themes. The codes define the ethical principles that serve as a foundation for all health care providers. The ADHA code describes the importance of oral health and the role of the dental hygienist in preventing and treating oral diseases. Advocating for patients is an important aspect of the code. The principles are described in a manner that applies to patients and clinicians. In addition, there are statements that address competence and personal well-being and that encourage teamwork and collaboration in the work environment. The importance of respect for colleagues and patients is also highlighted. The ADA and ADHA codes encourage practitioners to contribute to their professional organizations and research- and community-based efforts. The ADHA code specifically addresses the ethical obligation that dental hygienists have to their communities. The ADHA Code of Ethics supports an approach called a hierarchy of duties. The hierarchy suggests that professionals have obligations to society, employers, patients/clients, colleagues, and professional organizations. The American Dental Assistants Association has a creed that provides statements that are aspirational in nature, to guide their members and includes themes of teamwork, respect, loyalty, and tolerance.

CONTRIBUTING TO THE COMMON GOOD

Dental professionals are citizens of various "communities," including the local area where they reside or are employed. A population with a specific socioeconomic status, ethnic and religious affiliation, or other unique qualities may characterize this local community. The professional communities to which a dental provider belongs is defined by many factors, including

education, credentials, experiences, and interests. A dental hygienist may belong to the ADHA and a state and local dental hygiene component and the American Association of Public Health Dentistry (AAPHD). A dentist would have similar memberships and may belong to additional dental related groups such as the American College of Dentists, which has a strong ethical focus. Membership in local and state societies is dictated by the state and city where the dental provider resides. In addition, because of personal or professional interests, the dental provider may also hold memberships in other professional or service organizations. For example, a dental provider interested in oral cancer prevention and education may be an active member of the local American Cancer Society. An oral health care provider interested in dental public health may join a professional organization such as the AAPHD or the Association of State and Territorial Dental Directors. Each organization has a specific mission and assists the member by being a source of information on current trends, professional publications, and research. Many organizations provide membership opportunities for all members of the dental team, including public health (AAPHD), ethics (American Society for Dental Ethics), and research (International Association for Dental Research) as examples. Dental professionals are also members of a scientific community. To be a skilled professional, it is imperative to maintain a current knowledge level. Dental professionals use scientific publications, professional meetings and seminars, and continuing education resources to keep current in dental and related sciences. Decisions about patient care, oral health recommendations to patients and community groups, and approaches to resolving oral health problems must be based on sound scientific evidence. These reasons link dental professionals to the scientific community.

The participation in various communities, in conjunction with the professional education and credentials of an oral health care provider, includes a social responsibility. This social responsibility arises from the provider's ethical responsibilities of nonmaleficence and justice. The social responsibility is to take a specific action

or set of actions to address the oral health needs of a society, using the skills and knowledge of the professional. A professional may work independently to address needs or work in tangent with a larger group of professionals. There is a broad range of commitment to the social responsibility aspect of being a professional; for example, a dental hygienist or dentist in private practice who contributes twice a year to an oral cancer screening activity at a local retail mall. Other dental professionals may join the U.S. Public Health Service to provide services to many different groups, including Native Americans. In each instance, there is a commitment to improve the well-being of individuals and contribute to a better society.

The U.S. Surgeon General's Report highlighted that the distribution of oral diseases is disproportionate among the U.S. population. The report emphasized that certain ethnic and racial minority groups and the elderly, disabled, and medically compromised have a disproportionate amount of oral disease as compared with the rest of the population. This report triggered a series of initiatives focusing on oral health, educational and preventive strategies, and collaborative efforts between government agencies, educational institutions, and community groups. Oral health professionals can effect the changes needed to maintain and improve the oral health status of all citizens. A National Call to Action to Promote Oral Health outlines specific actions that could be taken, including

- change perceptions regarding oral health and disease, so that oral health becomes an accepted component of general health.
- accelerate building the scientific and evidence base and apply science effectively to improve oral health.
- build an effective infrastructure at the local, state, and national levels.
- strengthen and expand oral health research and educational capacity.
- remove known barriers between people and oral health services.
- use public-private partnerships and build on common goals to improve oral health.

These action steps direct providers to work toward the common good. The **common good**

is defined as working in a manner that benefits all people. Dental professionals easily understand the philosophy of striving to take steps to benefit the larger community. Dental professionals recognize individual rights. However, as members of a community, it is also the obligation of all members of the dental team to collaborate to benefit all citizens. Ethical oral health care providers put the interests and needs of the patients and communities before their own interests. The concept of contributing to the common good supports the earlier discussion of social justice and the obligation to develop and implement strategies to address unmet needs and improve the oral health and, consequently, the general health of society.

Oral health care professionals, especially those with a career in community-based service, contribute to the common good. Activities such as screening, preventive education, treatment, and referral are examples of actions that impact the well-being of a community. Fluoridation of community water supplies enhances the capacity to reduce caries in an area, benefiting many. Many dental hygiene and dental education programs have students provide oral health services to underserved or special needs populations in their communities. This community outreach experience for students is an example of contributing to the common good. When they graduate, students who participate in community outreach activities are enriched by their experiences and sensitized to their obligation to contribute to the well-being of people of all communities. The community benefits because the student-provided care allows access to services that may otherwise be unavailable. Licensed dental practitioners staffing community-based clinics, mobile dental van clinics, or other dental public health service sites are enhancing access to care and contributing to the common good. The members of the dental professions who use their skills to provide dental care in the community are contributing to a common purpose—to assist citizens within a community to attain and maintain oral health.

Communities are defined by geography; socioeconomic status; and cultural, religious, and ethnic characteristics. In addition to

considering the oral health status and needs of a specific community, the dental provider should demonstrate cultural competence and sensitivity. **Cultural competence** is described as having a defined set of values and principles that allow a provider to demonstrate behaviors and attitudes that enable them to work effectively cross-culturally. **Cultural sensitivity** is awareness that cultural differences and similarities exist, without assigning values (i.e., better or worse, right or wrong) to those cultural differences. **Cultural knowledge** is familiarization with the selected cultural characteristics, history, values, belief systems, and behaviors of members of another ethnic group. Awareness of religious or cultural beliefs that impact health beliefs and practices are critical on all levels. Culturally sensitive oral health care is a delivery system that is accessible and respects the beliefs, attitudes, and cultural lifestyles of the provider and the patient. The provider must be aware that different cultures view the aspect of health and illness in different ways; for example, an illness may be caused by a specific virus for one patient, whereas another patient may attribute the same illness to a spiritual imbalance. The provider caring for patients in a clinic that provides care to a Hispanic population understands the importance of autonomy and the need for the patient to understand their oral health status as they make decisions about treatment. The clinic may have health history questionnaires, patient information brochures, and informed consent forms written in Spanish to assure that patients are correctly comprehending and responding to inquiries about their health.

Communication is important in providing culturally competent care. The provider–patient interview is an opportunity to determine important features of the patient, including family dynamics, beliefs about health and illness, and specific concerns about oral and general health care. In other instances, cultural beliefs or practices may influence provider–patient interactions during treatment. Patients who traditionally may not complain about discomfort or pain will not share that information with the provider. The

provider, seeking to do no harm or prevent harm, must determine whether a patient is comfortable by relying on nonverbal responses or reactions.

When a dental professional is providing services in a community with cultural or religious practices different from his or her own, it is recommended that the provider take steps to become familiar with the culture, religion, and other characteristics of the patient population. Information can be solicited from colleagues, community or religious leaders, local community centers, focused research, and certain web sites. A practice, clinic, or center may have written or other resources available to all employees. Actions taken to treat patients with respect and understanding support all ethical principles, but particularly those of autonomy, justice, and non-maleficence.

ETHICAL DILEMMAS

The oral health care provider is frequently challenged by situations in which there is difficulty determining the ethically correct action, one in which there is not a simple solution. An **ethical dilemma** occurs when one duty or obligation is in conflict with another. For example, as part of the discussion with a dental provider at a dental clinic, a 28-year-old patient indicates that she wants all her teeth extracted. She explains that this is based on her limited financial resources, her family history of everyone “losing their teeth,” and her lack of interest to return to the clinic for multiple appointments. The dental provider understands that patient autonomy and respecting the patient’s right to determine his or her care is a necessary component of the patient–provider relationship. However, the provider also knows that extracting all of this patient’s teeth may create a potential for “harm.” Two ethical principles are in conflict: autonomy versus nonmaleficence.

Conflicts or dilemmas arise in community settings for other reasons. In public health settings or community sites where oral health services are provided, there are also instances in which professional values may be in conflict with community values. A simple example is

the nursing home setting. The nursing home “community” includes health care professionals, licensed and nonlicensed staff, and patients. A dental professional, following a needs assessment, may determine that specific dental services are needed for every resident. The nursing and nursing support staff may not agree, believing the priorities are staff education and in-service presentations focusing on general health issues and not oral health concerns. Conflicts arise between the two groups; however, each group is basing their beliefs and recommendations on ethical principles. The dental professionals are interested in promoting good, thus supporting beneficence. The staff, knowing that education assists the staff to screen for cancer, provides better preventive care, and prevents harm, is contributing to nonmaleficence. Both sides are advocating with an ethical principle as a foundation for their interest. A conflict may arise if there is a limited budget for the nursing home and a decision has to be made. Which recommendation will get funded? How might one make that decision? An ethical decision-making model is a framework that provides a strategy to resolve issues.

ETHICAL DILEMMA RESOLUTION FRAMEWORK

Individuals and dental teams are apt to face ethical dilemmas during their professional experiences. An **ethical decision framework** is recommended to give the provider a mechanism to address issues, individually or as part of a team. Ethical dilemmas cannot always be resolved by a code of ethics alone. It is useful to have a framework with which to analyze and make ethical decisions. The following framework suggests a method that can be used by providers in community or public health settings. The model recognizes the value of making a decision or choice and considers the profession’s viewpoint, as well as other stakeholders. The dilemmas encountered in community settings can involve provider–patient interactions, staff relationships, community networks and expectations,

and professional organization and political issues. The model encourages an approach to resolving the dilemma through the identification of multiple alternatives that are carefully evaluated. The individual or individuals responsible for solving the dilemma are required to gather information from multiple sources to allow for an informed decision. Each alternative is evaluated, using legal, ethical, and policy guides for anticipated outcomes. When an alternative is chosen, the model emphasizes which action should occur and which consequences should be evaluated.

1. Define the problem. A problem or dilemma occurs when ethical principles or obligations are in conflict.
2. Identify the stakeholders. Stakeholders include licensed and nonlicensed personnel, patients, the surrounding community, dental and interdisciplinary health colleagues, and professional associations and licensing agencies.
3. Identify available alternatives to the problem. In considering alternatives to resolve the dilemma, the individual using the decision-making framework must consider all alternatives. The purpose of the model is to encourage broad thinking. Frequently, in attempting to resolve ethical dilemmas, there is a tendency to think of one or two solutions, limiting possible alternatives. A few narrow choices reduce the possibility for a solution that would satisfy ethical and legal obligations.
4. Gather information to assist in evaluating the alternatives. Prior to evaluating the alternatives, seeking additional information that is important to better understand the dynamics of the current dilemma must occur. The type of information gathered is influenced by the dilemma presented. In instances in which a patient care dilemma is evident, reviewing the patient’s chart may provide all the information necessary to assist in evaluating possible alternatives to resolve a dilemma. If a dilemma is evident because of a pattern of behavior by a provider or employee, more information may be necessary, including information about organizational policies and procedures.

Examples of information to consider include the following:

- Data: including history, current health status, trends, and practices. Depending on the dilemma, the data sought can be for a patient, group of patients, or target population within a community, such as senior citizens.
 - Personnel: licensed and nonlicensed individuals, credentials, experience, and skill levels.
 - Cultural, ethnic, religious, and socioeconomic factors.
 - Rules and regulations: policies and procedures in a particular employment setting, standards of care, licensing, and other regulatory requirements.
 - Philosophical: the approach to oral health care.
 - Historical: previous practices, annual reports, or meeting minutes.
5. Each alternative must be evaluated individually, a process that involves viewing the alternatives using established guidelines, such as ethical codes. Evaluate the identified alternatives using the following filters. As each alternative is reviewed, consider the following:
- Review relevant ethical principles and codes.
 - Compare consistency with policies, procedures and guidelines.
 - Keep alternatives acceptable within applicable laws and regulations.
- Based on the evaluation, which alternatives best satisfy the ethical and legal principles that apply to the dilemma.
6. Following evaluation of the alternatives, the list should be prioritized. As each alternative is considered, list the anticipated outcomes for each alternative, positive and negative. The outcomes can include consequences to the provider, the patient, setting where care is provided, and other key stakeholders. For example, an alternative may include reporting unethical or illegal practices by a specific provider in a public clinic. If this alternative were chosen the outcomes might include improved quality of care, less risk to the patient and the clinic, and a message to all employees

that inappropriate behaviors are not tolerated. Additional outcomes may include loss of employment by those working in the clinic, patients losing access to care, harm to the reputation of the clinic and loss of funding. The evaluation of alternatives allows the individual experiencing the dilemma to carefully weigh the options using a thoughtful approach.

7. Make the decision. The decision should have a strong ethical foundation. A dental professional must rely on ethical principles to guide their behavior, even if some of the consequences of the decision may be unpleasant.
8. Act on the decision.
9. Evaluate the decision. The outcomes for acting on the decision may be immediate. This step in the process does not suggest modifying the decision, but rather preparing for outcomes and or strategies to prevent similar situations from arising in the future.

The ethical decision-making model provides an opportunity to evaluate the options throughout the process using the provider's understanding of the legal and ethical issues important to the situation.

USE OF THE ETHICAL DILEMMA RESOLUTION FRAMEWORK

The following scenario is provided, followed by an analysis using an ethical dilemma resolution framework.

Scenario: Substandard Care Provided

The city health department is located in a former major hospital near the downtown area. Most patients are residents of the metropolitan area and have dental care paid through the Medicaid program or assistance from other public organizations willing to pay for dental care. The dental clinic clearly informs the patients that it provides "cleanings, fillings, and extractions." No prosthodontic care is provided, although dentures are occasionally repaired because the staff dentist is willing to help out. There are two part-time dentists and one full-time dental hygienist. The

dental hygienist is completing a second year of employment at the clinic.

The dental hygienist is concerned about the quality of care provided by one dentist. At maintenance visit appointments, the dental hygienist repeatedly observes caries in teeth that have been restored by the dentist. The patients are unaware of the problem and happy that they have their “fillings.” The dental hygienist has observed that the same dentist is consistently responsible for not removing all the caries. She has discussed her concerns with the clinic manager who, although somewhat sympathetic, emphasizes how difficult it is to get dentists to work in the clinic. The clinic manager points out that the clinic has gone for months without a dentist on staff; she is just happy that there are two dentists willing to treat patients.

As part of the annual evaluation of the clinic and its services, the health department is conducting volunteer staff interviews to obtain feedback about the health department and its clinics and personnel. The announcement about the volunteer interviews indicated that all attempts would be made to keep all interview discussions confidential. The dental hygienist is interested in discussing her observations and concerns, but unsure about what to do. The scenario is discussed using the ethical dilemma resolution framework.

1. Define the problem. There are several conflicts presented in this scenario. The dental hygienist is aware that harm is occurring; the patients are not receiving optimal care; and the ethical principle of beneficence, do no harm, is compromised. The failure to remove all caries places the inadequately treated patient at risk for future dental problems. An opportunity exists for the dental hygienist to provide information about poor quality care so that steps to correct the problem can be implemented. The information could result in the dentist's employment being terminated; however, if the dental hygienist does not inform someone about the compromised care, her integrity and honesty, or veracity, is compromised. Justice is also a concern. The patients treated by the dentist should receive the same quality of care as the patients whose treatment is provided by the other dentist on staff. All dentists providing care should meet the technical standard for removing all caries from a tooth.
2. Identify the stakeholders. The stakeholders are primarily those patients in the community who rely on the dental clinic to provide dental services. Care for each patient treated by the dentist is of poor quality. Additional stakeholders include the public health clinic (as the employer) and the dental hygienist who works with the dentist and the dental community.
3. Identify possible alternatives to the problem. Possible alternatives include the following:
 - a. The dental hygienist can speak with the dentist and use radiographs to assist in identifying the caries removal problem.
 - b. The dental hygienist could speak to the other dentist in the clinic, share the radiographs, and suggest the dentist discuss the issue with the dental colleague.
 - c. The dental hygienist could notify the individual conducting the quality assurance assessment of the trends observed in patient care and recommend that a peer review evaluation be conducted by a dentist.
 - d. The dental hygienist could contact the professional association state peer review board.
 - e. The dental hygienist could ignore the situation.
 - f. The dental hygienist can voluntarily terminate employment at the clinic
4. Gather information to assist you in evaluating the alternatives. In preparation for prioritizing the alternatives, the dental hygienist can take several steps:
 - a. Determine the length of employment and years of practice for the dentist.
 - b. Contact the state board of dentistry to determine if issues of lack of competence for that particular dentist are documented and on record.
 - c. Conduct a chart review so that a sample of patients treated by that dentist could

- be reviewed to determine if poor caries removal is a consistent or long-term problem. The chart review could be conducted by the other dentist on staff, to assess each patient's oral health status, number of visits, cooperation level, and preventive practices.
- d. The dental hygienist could also determine how appointment scheduling occurs and if adequate time is allotted for patient care.
 - e. The dental hygienist may be aware of the dentist's philosophy of care from working together in the same clinic.
 - f. Determine if a peer review process or staff evaluation occurs as part of the policies of the clinic. There may be evaluation mechanisms in place that could be used to make the appropriate supervisors aware of the situation.
5. Evaluate the identified alternatives. The dental hygienist should evaluate each alternative using a variety of available resources. The ADHA code of ethics encourages dental hygienists to act as patient advocates. In this instance, the dental patient is unaware of the quality of care that is provided. The ethical principles of beneficence, doing good, and nonmaleficence, do no harm, are important to the facts. The dentist is providing care that is substandard. The patient is at risk for future problems. The dental hygienist is aware of this and, to be fair, must let someone know the truth. Each ethical principle can be applied to this scenario and used to evaluate each alternative. Within the health department, policies and procedures for communicating issues or concerns may be available, including quality assurance reporting mechanisms, patient advocates, specific feedback forms, or other mechanisms, to assist the dental hygienist. Patient treatment guidelines or standards may also exist that are used by the dental clinic for peer evaluation. Professional association peer review protocols need to be evaluated to see if they exist and to learn the mechanism for reporting members.
 6. Rank the alternatives. Each alternative has advantages and disadvantages for the dental hygienist, the dentist involved, and the patients treated by the dentist. The dental hygienist must consider the anticipated outcome of each chosen alternative. The ranking must be based on sound ethical and legal principles. The dental hygienist should consider the impact of each alternative on the work environment and the interpersonal relationships within the office. The patient's interests are paramount in the ranking because of the ethical obligations of preventing harm and promoting good. Reviewing each alternative and ranking them from worst to best forces the dental hygienist to consider all aspects of the issue. However, because there are multiple factors involved, there is a possibility that, although the first ranked alternative is the best choice, it is the second ranked alternative that will be chosen by the dental hygienist. In all instances, the dental hygienist is most likely guided by the principle of doing the right thing, even if it means the decision will jeopardize the relationship with the dentist. The dental hygienist is interested in protecting the health and well-being of the patients who trust the health department to provide optimum care.
 7. Make a decision. The dental hygienist, or any provider faced with a dilemma, must make a decision to resolve the dilemma. This decision is based on a thorough analysis of the situation, the options available, and the potential outcomes for each alternative. It is important that a decision be made that allows resolution of the issue.
 8. Act on the decision. This particular step may appear to be an understood aspect of the decision-making framework. The dental provider must follow through on the alternative chosen, taking the steps to complete the process. Delaying or avoiding a resolution to the problem creates additional dilemmas and, depending on the circumstances, may lead to violation of legal obligations.
 9. Evaluate the decision. The evaluation process begins when the decision is acted on. The consequences may be immediate. For example, if the dental hygienist chose to report the

dentist to the quality assurance representative, the dentist may resign from the position on notification of the allegation. Or, in some circumstances, because the dental hygienist notified the appropriate personnel, the dental hygienist's employment may be terminated. Each alternative must be weighed for personal and professional consequences. Yet, each dental provider is obligated by their code of ethics to fulfill the obligations suggested by each ethical principle.

CASES WITH ETHICAL DILEMMAS

Use the ethical decision-making model to resolve the issues presented in Cases 1 to 6 or use them to discuss the concepts presented in the chapter.

Case 1: Professional versus Community Values

It's My Money and My Child! The dental provider is noticing a trend in the patients visiting the dental clinic located in the local health department. Many teenage clients are requesting stainless steel crowns for their anterior teeth. A popular musician wears the stainless steel crowns during concerts, and his young audience wants to look like him. The teenagers' crowns are not covered by dental insurance or other subsidies. In most cases, however, the parents are finding the financial resources to pay for the care. The dental provider is concerned because the trend is increasing. However, the patients, although requesting the crowns for healthy teeth, are declining preventive care, including maintenance visits and needed restorative work. The parents claim they want their financial resources to go toward the crowns, not the other dental care. The parents all indicate that they should get what they ask for because, after all, "it's my money and my child!" What should the provider do to resolve the conflict?

Case 2: Allocation of Resources

Who Receives the Grant? The dental provider in charge of the dental portion of a health clinic

located in the Hispanic community recently received notification that a grant application was successful. A local foundation agreed to provide \$500,000 to support a preventive dentistry program coordinated by the dental clinic. Following consultation with other members of the interdisciplinary health team, two primary groups were identified that could benefit from the funds. The first group is the significant number of teenage parents within the community. An oral health education program is needed that focuses on infant oral health, preventive strategies, and diet and nutrition. Educating the teenage parents about oral health, tobacco use, and the role of diet and nutrition on oral health should be addressed. At the same time, the clinic staff also identified the number of elderly in the community, many without teeth and needing dentures. The physician in charge of the health clinic decided to let the dental provider choose which target group should benefit from the funds. The dental provider is now faced with a dilemma. What should be done?

Case 3: Providing Services Beyond the Scope of Practice

It's Our Secret! A dental hygienist recently joined the staff of a dental clinic located in an isolated, rural area of the state. The clinic had been seeking to employ a licensed dental hygienist for a long time. Because of a spousal relocation, the dental hygienist was happy to find employment. One dentist and a full-time dental assistant staffed the dental clinic. The dental assistant was a long-time employee who lived in the community. For the first 6 months, the new dental hygienist enjoyed the work environment, collegiality, and patients. On a few occasions, while passing one of the dentist's operatories, she noticed the dental assistant performing root planing or scaling the teeth and, sometimes, polishing. The law in the state where the dental clinic was located did not allow dental assistants to perform those procedures. The dental hygienist knew that dental assistants could not practice like a dental hygienist because, prior to getting a license, she had to take the state's jurisprudence test—the law is

clear. The dental hygienist decided to approach the dentist to determine if the observations were correct. The response of the dentist surprised the dental hygienist. He indicated that because it had been difficult to employ a dental hygienist, a decision was made to allow the dental assistant to perform as a dental hygienist when required by the circumstances. The dentist assured the dental hygienist that the assistant was skilled because he had “trained” her. The assistant had read a few of his textbooks and had attended a continuing-education course for dental hygienists. The dentist assured the dental hygienist that it was in the community’s best interest to have two employees providing dental hygiene services to “meet the needs of the community.” He also emphasized that the patients did not know the difference between a dental assistant and dental hygienist. He ended the conversation by reminding the dental hygienist that no one would find out if no one shared the “secret.” What should the dental hygienist do?

Case 4: Failure to Follow Appropriate Legal Mandates

It’s the Mayor! The dentist’s office scheduled the mayor’s 8-year-old daughter for prophylaxis, radiographs, fluoride treatment, and examination. During the intraoral examination, the dental hygienist noted some bruising on the child’s soft palate and frenum. The little girl was wearing a turtleneck with long sleeves, which was unusual in the warm and humid July weather. During the head and neck examination, the dental hygienist also noticed some bruising along the back of the neck. The girl was cooperative and responded to all the requests made by the provider during the treatment phase. The provider waited until the end of the appointment, when the girl appeared a little more comfortable, to ask about the bruises in her mouth and on her neck. The little girl became quiet and pensive. The dental hygienist tried a few more times to elicit responses, but the child indicated she wanted to see her mother. The dental hygienist left the operator to talk with the dentist prior to the dentist examining the child. The dentist listened and then went to the opera-

tory to complete the examination. He dismissed the child. At the end of the day, he indicated that he wanted to speak with the dental hygienist. The dental hygienist assumed that they would discuss a concern about potential child abuse that, under state law, must be reported. Instead, the dentist chastised the dental hygienist for even suggesting abuse had occurred. After all, she’s the mayor’s daughter! What should the dental hygienist do?

Case 5: Substandard Care and Insurance Fraud

We’re Doing Them a Favor! During an office staff meeting, the dental hygienist was pleased to hear that the office was going to begin scheduling Medicaid patients for treatment. The community where the practice was located was near a section of the city that was popular with immigrants settling in the area. Many immigrants qualified for Medicaid and other social service benefits. The office manager indicated that the component dental society was putting “pressure” on dentists in the community to provide access to care to the underserved members of the community. The day following the meeting, the dental hygienist and office manager had a private conversation prior to the first patient’s arrival. The office manager indicated that all Medicaid patients would be allowed 30 minutes with the dental hygienist. The office manager indicated that the dental hygienist should perform a “rubber cup prophylaxis” for all children and adults, give them a toothbrush with some fluoridated toothpaste, and dismiss them. However, the dental hygienist’s records would indicate more treatment than occurred. For adult patients, root planing and scaling, radiographs, examination, and patient education would be recorded. For child patients, prophylaxis, fluoride treatment, and radiographs would be recorded. The office manager indicated that Medicaid reimbursement was not adequate. The dentist had decided to provide some treatment but would bill for as much as possible to “cover the costs.” The office manager commented that, at least, the patients were receiving some treatment. What should the dental hygienist do?

Case 6: Politics versus Professional Obligations

Supervision Required. A dental hygienist is employed by the state public health division to provide care in isolated clinics throughout the state. The service has a mobile dental van that travels from community to community, providing treatment. Local dentists are asked to volunteer their time and provide restorative care; however, the assigned dentists are frequently not available or choose not to staff the mobile van.

One dentist in the state is a strong advocate of expanded duties for dental hygienists who choose to be employed in community-based settings. His recommendation includes training public health dental hygienists to do preventive resin restorations (PRRs). His argument is that many children seen in the clinics or mobile vans return year after year for prophylaxes but, because of a lack of dental providers, have little or no restorative work provided. Each year, the caries in the children becomes more serious and results, for many children, in toothaches and, ultimately, extractions. Allowing public health dental hygienists to do PRR would begin to address the significant needs of the children.

The dentist is active in the local dental society and has made his views known at local and state meetings. Recently, however, rumors have started about his past. Apparently, the dentist, while battling a substance abuse problem, had been in trouble with the law. A few people know about his past, including one of the dental hygienists staffing the dental van. A public hearing is going to be held at the state board level to discuss the proposed change to the state law that would allow dental hygienists to do certain additional procedures. The dental hygienist has been approached by a number of dentists, through e-mail and telephone calls, to talk about the advocate dentist's past. Certain dentists in the state want to harm his reputation, so that state board members and other influential dentists question his credibility. At least one dentist has indicated that if the dental hygienist did not cooperate, funding for the mobile van might disappear. What should the dental hygienist do?

SKILLS FOR ETHICAL PRACTICE OF PUBLIC HEALTH

The focus on creating an ethical workforce continues to be integral to the education of dental, medical, and public health professionals. The Institute of Medicine Report on Who Will Keep the Public Healthy,⁶ recommends the inclusion of ethics in public health curricula. Dental, dental hygiene, and dental assisting education have a history of including ethics education as part of their curricula, as well as their accreditation standards. The need for all providers to have specific ethical skills supports the important role ethics and ethical decision making has in the delivery of services. The Public Health Leadership Society⁷ summarizes Skills for the Ethical Practice of Public Health. The skills serve as a complimentary listing to the professional codes discussed in the chapter and highlight meeting the needs of a community, increasing access and removing barriers, developing appropriate policies, recognizing diversity in values, beliefs and cultures, competent care and collaborative efforts.

Summary

All members of the dental team are obligated to practice using ethical principles and codes of ethics for guidance. The dental hygienist involved in community service, provision of care, or education is expected to demonstrate professional behavior. In addition, the dental hygienist is required to fulfill professional responsibilities, including competency; sensitivity to cultural, ethnic, and religious characteristics; written and oral communication skills; and contributing to the well-being of the community. In situations in which the dental hygienist encounters an ethical dilemma, the use of an ethical decision-making framework provides a structured assessment and resolution of the problem. The framework can be used for patient-provider, colleague-to-colleague, and provider-to-community dilemmas. Dental hygienists and all health care providers recognize the importance of ethics and ethical decision making as a core aspect of the profession.

Learning Activities

1. Develop a Code of Ethics. Divide a class into small groups and assign the task of drafting a class code of ethics. The code can address relationships with student colleagues, faculty, and staff, as well as a student Code of Conduct. Each group can report their suggestions. Compile the consistent themes and adopt the code as a guiding framework to be used during enrollment in the program.
2. Obtain a copy of the ADA Principles of Ethics and Code of Professional Conduct and the ADHA Code of Ethics. Review both codes. Identify common themes and principles. Identify how and where obligations to society and community are identified in each code.
3. Identify actions that a dental professional can take to contribute to the “common good” of their local community. Begin by identifying the action and what steps would be needed for the action to be implemented. Identify the target group, anticipated outcomes, potential collaborators within and outside the dental profession, and possible sources of funding.
4. Think about ethical dilemmas that you have experienced as a student, employee, or employer. Summarize the dilemma, in writing or in a group, and identify which ethical principles were violated. Use the ethical decision-making model to “solve” the dilemma, allowing classmates or colleagues to present alternatives. Discuss if the dilemma was resolved and what approach was taken to resolve it. What were the consequences of the resolution?
5. Using the cases presented in this chapter, or other individually reported cases, role play a conversation between the dental provider faced with the dilemma and a key figure in the dilemma.
6. Invite local dental public health practitioners to discuss ethical issues and specific cases with students. Distribute the issues or cases prior to the class meeting, divide the class into small groups, and assign practitioners to each group. If the practitioners are unable to visit a

class, assign students to interview individuals by visiting community sites.

7. Research a particular ethnic or cultural group and their health beliefs and practices. Discuss how the knowledge gained would influence the interaction between a dental provider and patient.

Resources

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- American Dental Education Association. Available at: <http://www.adea.org>
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- International Dental Ethics and Law Society: IDEALS. Available at: <http://www.ideals.ac>
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Review Questions

- The local health department is interested in purchasing a mobile dental van that would allow access to care for regions of the city that do not have dental practitioners. A health department dental hygienist wants to collect data about oral health status from elementary school children and begins visiting the schools and evaluating the children, using an oral hygiene index. She fails to obtain consent from the children's parents for the evaluation. Which of the following ethical principles did the dental hygienist violate?
 - Autonomy
 - Beneficence
 - Justice
 - Veracity
 - Fidelity
- The clinic dentist is running late and is noticeably flustered. She quickly reviews the chart and proceeds to begin the extraction. The dental assistant is surprised to see that instead of extracting tooth #3, as treatment planned, the dentist is extracting #4. The dental assistant discreetly points to tooth #3 and the treatment plan sitting on the counter. The dentist, realizing her mistake, replaces #4 in the extraction site, extracts #3, and sutures the patient. She provides postoperative instructions and reminds the patient to make an appointment to have the extraction site checked. The dentist says nothing to the patient about the wrong tooth being extracted. Which of the following ethical violations did the dentist violate?
 - Autonomy
 - Beneficence
 - Justice
 - Veracity
 - Fidelity
- A small dental clinic is the recipient of grant funding. There are no specific stipulations about how the funds should be used, only that they should contribute to the improvement of oral health in the community. The dental provider charged with using the funds decides she wants use the money in a way that would benefit a significant portion of the community, in this case, the senior citizens residing in the town. Which of the following ethical theories does this dental provider's actions support?
 - Deontological ethics
 - Utilitarian ethics
 - Virtue ethics
 - Professional ethics
 - Antifraud ethics
- Which of the following are characteristics of a profession?
 - (1) Adherence to a code of ethics; (2) Specialized and rigorous academic training; (3) Monitoring by colleagues; (4) Professional association membership requiring dues; and (5) Service orientation
 - 1, 2, and 3
 - 1, 2, 3, and 5
 - 2, 3, and 4
 - 1, 2, 4, and 5
 - 1, 3, and 5
- A dental assistant is employed on a Native American Reservation. The assistant is working with local tribal leaders to address certain oral health problems evident in the community. The dental assistant seeks the advice and input of the member of the tribe that has traditionally provided medical advice and care to the tribe's members. The dental assistant is interested in learning how oral

health problems, including caries and periodontal disease, have been addressed by the tribal members. Which of the following is the dental assistant attempting to improve?

- a. Cultural competence
 - b. Cultural sensitivity
 - c. Cultural knowledge
 - d. Cultural domain
 - e. Cultural practices
6. A dental hygiene program allows its students to provide care in an outreach clinic located in a part of town where there has been an influx of Spanish-speaking immigrants. The dental hygiene program makes a curriculum change, requiring all students to enroll in a conversational Spanish class so that students and patients can communicate clearly and accurately. Which of the following National Call to Action steps is the dental hygiene program addressing?
- a. Changing perceptions regarding oral health and disease, so that oral health becomes an accepted component of general health.
 - b. Building an effective infrastructure at the local, state, and national levels.
 - c. Removing known barriers between people and oral health services.
 - d. Using public-private partnerships and building on common goals to improve oral health.

Questions 7 to 10. Use the following scenario as a basis to respond to Questions 7 to 10.

A dental hygienist, a recent graduate, is the newest staff member of a progressive clinic. The quality that attracted the dental hygienist to the position was the apparent commitment of the office to treating all patients from the surrounding community. She has been seeing various patients; some self-pay, others have their care paid for by state Medicaid funds. Today's patient is covered by Medicaid. During the intraoral examination, the dental hygienist notes a lesion that may require biopsy. The dental hygienist brings the lesion to the attention of the supervising dentist,

who indicates that it is not "anything to worry about." The dental hygienist is surprised that the dentist did not make a recommendation for an evaluation of the lesion. Later in the day, the dentist comments that "he didn't make the recommendation because most people like her patient don't follow through on recommendations." The dental hygienist is concerned at the dentist's philosophy of care. More significantly, the dental hygienist is concerned about the patient's well-being.

7. The dentist's failure to refer the patient for a biopsy violates which of the following ethical principles?
 - a. Autonomy
 - b. Beneficence
 - c. Veracity
 - d. Fidelity
 - e. Competence
8. The dental hygienist decides to use the ethical dilemma resolution framework to resolve the situation. Which of the following is NOT an ethically-based alternative to consider?
 - a. Reappoint the patient and have another dentist on staff examine the lesion.
 - b. Talk with the dentist about the dental hygienist's concern about the patient and reappoint the patient so that the dentist can reexamine the lesion.
 - c. Reappoint the patient and ask a dental hygiene colleague to conduct an examination.
 - d. Wait until the patient returns for a maintenance visit in 6 months and see how the lesion appears.
 - e. Call the patient and encourage them to get a second opinion.
9. Prior to considering all the alternatives recommended, the dental hygienist gathers information that would be useful. Which of the following is the type of information that should be obtained?
 - a. A careful review of the patient's chart and previous intra- and extraoral findings
 - b. Review an oral pathology book specifically related to oral lesions similar to the one observed

- c. The referral policies and protocol followed by the office
 - d. a and c only
 - e. a, b, and c
10. The dental hygienist chooses to confront the dentist, based on a belief that all patients in an office should receive the same treatment. Which of the following ethical principles influenced the dental hygienist in her reasoning?
- a. Autonomy
 - b. Veracity
 - c. Justice
 - d. Confidentiality
 - e. Beneficence
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 - 4. American Dental Association. Principles of Ethics and Code of Professional Conduct. Available at: <http://www.ada.org/prof/prac/law/code/index.asp>. Accessed May 2009.
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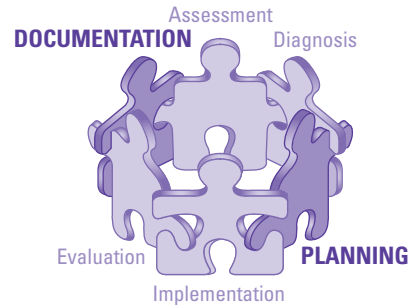
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Legal Principles

Objectives

After studying this chapter, and completing the study questions and activities, the learner will be able to:

- Describe contract principles and associated duties for providers and patients.
- Identify intentional torts that a dental provider may be at risk for committing.
- Describe the intentional tort of negligence and the elements necessary to prove a provider negligent.
- Describe the necessary criteria to obtain an informed consent.
- Describe the necessary criteria to obtain an informed refusal.
- List common exceptions to obtaining an informed consent.
- Describe the concept of standard of care and related duties to meet the standard for dental providers.
- Describe recommended risk management techniques.
- Describe the purpose of a state dental practice act.
- Describe the steps involved for a proposed bill to become a law.
- Describe federal laws that prevent discriminatory practices by employers and protect the safety and health of employees and wage and employment benefits.



KEY TERMS

Abandonment
Administrative law
Assault
Assignment
Battery
Beyond a reasonable doubt
Civil law
Collaborative practice
Consideration
Contract law
Damages
Deceit
Defamation of character
Defendant

Dental practice act
Direct supervision
Duty
Express contract
False imprisonment
Fraud
General supervision
Implied contract
Implied duties
Indirect supervision
Informed consent
Informed refusal
Intentional tort
Laws

Libel
National Practitioner Data Bank (NPDB)
Negligence
Plaintiff
Preponderance of evidence
Slander
Standard of care
Statute of limitations
Technical battery
Tort law
Trespass
Unintentional tort
Unsupervised practice

See Appendix 3 for the ADEA competencies addressed in this chapter.¹

Introduction

All members of the dental team, as part of their professional responsibility, attempt to comply with the laws that regulate the practice of their profession. Each dental professional makes decisions or provides treatment with the goal of fulfilling their legal obligations as a health care provider. Allegations resulting in a lawsuit can occur on many levels. Patients may sue oral health care providers or an employee may sue an employer. The oral health care provider must be aware of legal principles—to guide their actions, written and verbal communication, and personal and professional relationships. In addition, oral health care providers employed in community-based settings may also be negotiating contracts, conducting research, lobbying, and advocating for a particular target group or change in legislation and may need a foundational knowledge of the legal system as a tool they can use in their many roles.

THE PURPOSE OF LAWS

Laws are developed to protect the public. The drafting and implementing of a specific law is a codification of rules with specific consequences. Law is a rule of conduct or action prescribed or formally recognized as binding or enforced by a controlled authority. The purpose of laws is to regulate the behavior of citizens and protect the public's oral health and well-being. Laws are described as the minimum standard required to keep a society functioning. Issues and concerns in society influence the development of specific laws. A new law is drafted and instituted because of changing patterns of behavior and values, technology, advancements in science, and other influences on lifestyle. With the increased use of computers, for example, privacy laws have been updated to include protection from identity theft or purchase fraud. Laws are developed to contribute to a civilized society, one in which people conform to certain behaviors to prevent harm.

OVERVIEW OF THE LEGAL SYSTEM

The United States' legal system has one federal legal system and 50 separate state systems. The federal government administers the U.S. Tax Court, whereas state government administers traffic or small claim courts. The state government also administers dental and dental hygiene licensing acts.

There are multiple sources of law. Constitutional law includes laws derived through both the U.S. Constitution and the constitutions of individual states. The Constitution, however, only addresses the relationship between individuals and the government. An additional source of law is when elected officials in governing bodies, such as the U.S. Congress or a state legislature, enact a law to become effective at a specific date. The Congress and state legislatures enact statutory and legislative laws. Lower jurisdictions, such as a city government, may enact codes or municipal ordinances. Laws passed by Congress impact the entire United States, whereas state law or local law is specific to an individual state or city.

Another source of law is common law or case law. English Common Law is based on principles, including justice, reason, and common sense. When these principles are applied to a specific situation, such as during a trial, they become case law. Case law is developed when a court explains or interprets other sources of law (e.g., when a case interprets the meaning of a particular statute). In addition to interpreting other sources of law, common law may define other legal rights and obligations. For example, a provider's obligation to use reasonable care in treating a patient is a legal obligation from a series of court cases. If the case is decided in federal court, it has a wider impact. Case outcomes determined by an appellate or state court are state specific.

Laws are classified as public and private. Public law includes criminal, administrative, constitutional, and international law. Private laws or civil laws include tort, contract, property, inheritance, family, and corporate law. Health care

providers need to know about two specific areas in civil law, tort, and contract law.

Civil Law

Civil law focuses on the relationships between individuals or between individuals and the government. Two areas of civil law are **tort law** and **contract law**. Tort law includes acts that result in harm against another person. The acts are classified as intentional or unintentional. Contract law is a violation of an agreement or promise between two persons to do or not to do something. The two parties in a lawsuit are the **plaintiff**, the individual bringing charges in the lawsuit, and the **defendant**, the individual or party against whom criminal or civil charges are brought in a lawsuit. In a civil law trial, the jury is asked to listen to the evidence presented by the plaintiff and the defendant and make a decision of guilt or innocence. The standard used by the jury to make a decision in a civil trial for a determination of guilt or innocence is **preponderance of evidence**. Preponderance of evidence means that the attorney arguing one side of the case must demonstrate a greater weight of evidence than the other side. The plaintiff must provide that it is more likely than not, that a provider caused the injury. The evidence may include dental records, scientific publications, and oral testimony by expert witnesses. In a criminal trial, the level of proof required is **beyond a reasonable doubt**.

Contract law addresses a breach or neglect of a legally binding agreement. A breach of contract may be alleged if either individual or party involved fails to comply with the terms of the legally valid contract. The agreement is referred to as a contract, which is a voluntary agreement between two parties in which specific promises are made for **consideration**. Consideration is a legal term meaning something of value is bargained. In dentistry, the consideration for the extraction of a tooth is a specific fee. There is an agreement between two parties because the oral surgeon offers to extract the tooth and the patient accepts. A contract is only valid if both parties are competent. Competence indicates

that the individual is mentally competent and not mentally ill or incapacitated or making the agreement under the influence of drugs or alcohol.

For purposes of a contractual agreement, minors lack competence, although there are special situations when a minor can legally consent. In most situations, a minor, an individual below the age of 18 (or in some states 21), cannot consent to treatment. Only a parent or legal guardian is able to consent for a minor in nonemergency situations. There are exceptions, including the mature minor, an individual younger than age 18 who is mature enough to understand a physician's instructions and obtain medical care for treatment of drug, alcohol abuse, contraception, venereal disease, or pregnancy. Some state laws clearly define those rights. An emancipated minor is an individual between the ages of 15 and 18 who is self-supporting and not living with or financially reliant on a parent and who may have children, be married, or be in the military. Parental consent is not required. Proof of the emancipation should be kept in the dental record (e.g., marriage certificate).

Two types of contracts exist: express and implied contracts. An **express contract** is an agreement that is explicitly stated, either orally or in writing. For example, a written treatment plan that describes the procedures to be performed and the costs of the procedures may be viewed as an express contract. To be legally valid in some states, some contracts must be in writing. In particular states, the Statute of Frauds indicates which contracts must be in writing. In those states, the contract that is frequently impacted is the third-party payer contract. This contract is a written agreement signed by a party other than the patient who promises to pay the bill. If, for example, a grandmother agrees to pay a visiting grandson's dental bill for an emergency root canal, the dental office may ask the grandmother to sign a third-party payer contract. An **implied contract** is an agreement that is shown by inference through signs, inaction, or silence. Therefore, it is the conduct of the parties that created the contract, not specific or expressed words. A patient with an appointment in a dental

office is examined by the dentist and treated by the dental hygienist. There is no statement of offer or acceptance or discussion of consideration. However, the patient's actions imply a promise to pay for the services. The action of the patient and the dental provider implies an agreement.

Dental providers do not always state an agreement in writing, or explicitly, using words. The terms of the contract are not listed or outlined. However, the courts have determined that there are many terms implied because of the provider–patient relationship, referred to as **implied duties**. There are implied duties owed by the provider to the patient and implied duties owed by the patient:

- Exercise reasonable skill, care, and judgment in the assessment, diagnosis, and treatment of patients.
- Have proper license and registration, comply with all laws, and practice within the scope of practice dictated by state law.
- Use standard drugs, materials, and techniques; refrain from experimental procedures.
- Never abandon the patient; arrange for care during absences.
- Charge reasonable fees based on community standards.
- Complete procedures within a reasonable time.
- Inform the patient of progress and of any untoward incidents.
- Obtain informed consent.
- Refer unusual cases to specialists.
- Maintain patient privacy and confidentiality.
- Keep accurate records.
- Maintain a current level of knowledge.
- Practice in a manner consistent with a code of ethics for the profession.

There are also duties owed by the patient to the provider, which include the following:

- Follow home oral health care instructions.
- Keep appointments and notify a provider if an appointment cannot be kept.
- Pay fees for services in a reasonable time.
- Cooperate with the provider.

- Give honest answers to information requested.
- Notify a dental provider if a patient's health status has changed or if there are changes in medications.

When a provider has agreed, either in writing or by action, to have a professional relationship with a patient, the contract relationship cannot be terminated improperly. A relationship between a provider and patient can terminate if, for example, the patient moves to another location or the provider is a specialist and the treatment required is completed. However, if dental providers fail to provide formal notice of the ending of a relationship, they may be accused of abandonment. **Abandonment** is the discontinuation of an established patient–provider relationship. A dental office or clinic should inform the patient in writing that the relationship is ended for protection from accusations of abandonment. The letter can indicate a notice that the relationship is being terminated with or without a reason, which should be presented using professional, nonsubjective, or accusatory language. The letter may identify a reason for termination including

- failure to schedule maintenance appointments
- failure to resolve an unpaid balance or pay for a service
- repeated missed appointments
- failure to follow instructions
- disagreement about treatment philosophy
- a written or oral statement from the patients that they are seeking the care of another dentist (e.g., their insurance coverage has changed).

The letter also should include a specific date that the relationship is terminated and an offer to provide emergency care during that period. The letter should encourage the patient to seek another provider and indicate that dental records will be forwarded to another provider, for a reasonable fee, upon receiving a signed request from the patient. It should be noted that patients have a right to a copy of their record whether or not a balance is owed. States may also have a medical

records act that defines the fees that can be charged for a record as well as indicate that indigent patients cannot be charged a fee for a copy of their record to be forwarded to another provider.

Tort Law

Tort law is a civil violation in which an individual harms another person's (body), privacy, or property because of negligent or intentional actions. To sue for a tort, a patient or employee must have suffered mental or physical injury. When an individual is found to have harmed another, the injured person is allowed by law to seek a remedy, damages, in a civil lawsuit. **Damages** are monetary compensation. If the conduct is considered malicious or fraudulent, then another category of damages, punitive damages, can be granted. Punitive damages are damages over and above the award to compensate for harm.

There are two categories of torts—intentional and unintentional. An **intentional tort** is a deliberate and purposeful act that has a substantial certainty of untoward consequences from the act. Intentional torts include assault, battery, deceit, defamation of character, false imprisonment, fraud, trespass, or invasion of privacy. Dental professionals, like all citizens, can be subject to allegations of an intentional tort. **Battery** is any bodily contact without permission, also described as unlawful touching without consent. **Technical battery** is when a dental provider, in the course of treatment, exceeds the consent provided by a patient. Although no wrongful intent is present and there is a sincere interest to treat the patient, there still may be damages awarded. If the patient does gain some benefit, nominal damages may be awarded. If a restraint device is used on a child without parental permission and harm occurs, a battery may be alleged. If a dentist is given consent to extract tooth #30 and proceeds to extract #31 and no patient consent occurred, a technical battery may be alleged. **Assault** is threat of bodily harm. There does not have to be any physical contact for an assault to occur. Threatening to harm a patient with specific actions, resulting in apprehension, is a form of assault. A dental provider threatening to “hurt” someone if the

“patient does not cooperate” may cause apprehension, especially if the statements are made in a harsh, loud manner. Dental professionals may also be accused of **deceit**—a false statement or deceptive practice with intent to injure someone. **Defamation of character** is the wrongful act of injuring someone's reputation by making false statements in writing (**libel**) or verbally (**slander**). **False imprisonment** or false arrest is unlawful restraint. **Fraud** is described as dishonest or deceitful practices in depriving or attempting to deprive another of his or her rights. An individual that misappropriates funds that were designated to pay for dental care is depriving a population of their right to access to dental services. **Trespass** is injury or interference with the property of another. Invasion of privacy is interference with a person's freedom from intrusion.

The **unintentional tort** is **negligence**. Unlike intentional torts, there is no intent to cause harm. Negligence is an unintentional tort alleged when one may have performed or failed to perform an act that a reasonable person would have done in similar circumstances. The following elements must be present to determine that a dental provider is guilty of negligence:

- A duty or legally recognized obligation exists.
- A breach of duty occurred. This can be an act of commission or omission.
- The breach of duty was a direct cause of the patient's injury.
- There is a legally recognizable injury.

The burden to prove the defendant guilty is on the plaintiff. An important question to consider is duty. **Duty** is defined as an action or conduct based on a legal obligation. A dental provider is required to meet various duties based on the accepted scope of practice allowed in a particular state. Dental hygienists conduct assessment, determine dental hygiene diagnoses, develop a treatment plan, provide treatment, and evaluate outcomes. One cannot list a specific set of duties; however, some examples are to competently and appropriately treat, refer to dental specialists or physicians for consultations, provide patient education, and clearly communicate to allow for informed consent or refusal.

Dental providers must meet the **standard of care** in all settings where care is provided. Standard of care is the level of care expected of a reasonable and prudent practitioner in the same or similar circumstances. Dental hygienists are educated and expected to complete certain procedures during the various phases of dental hygiene care. Any compromise of care resulting in harm to a patient could be interpreted as failure to meet a duty. The dental hygienist that inadequately completes a health history may not identify a health condition requiring premedication. The dental hygienist has a duty to carefully review the health history, ask appropriate follow-up questions and, if necessary, obtain a medical consult. A dental hygienist has a duty to thoroughly scale and root plane a periodontally involved patient to control disease. Failure to adequately sterilize and sharpen instruments, treat disease, educate the patient, and provide postcare instructions are all examples of dental hygiene obligations that, if not done prudently and reasonably, may result in patient harm. The resulting harm may include infection, trauma, and periodontal disease advancing to a more serious state. The patient needs to allege the negligence and provide proof of the direct relationship between what the dental hygienist did or did not do (an act of commission or omission) during the appointment that led to harm.

Informed Consent and Refusal

One important duty that is based both on ethical and legal principles is the need to obtain **informed consent** from the patient for treatment they receive. Informed consent is the act of providing information and assuring that the patient understands the treatment risks and advantages, options available, and the nature of the disease or problem. The act of obtaining an informed consent recognizes the patient's autonomy and their right to determine what treatment they do or do not receive. The elements of informed consent require the dental provider to explain the following, using understandable language:

- The proposed treatment for the identified disease or diagnosis
- Reason(s) the treatment is necessary
- The advantages and risks of the proposed treatment
- Available alternatives to the proposed treatment
- The advantages and risks of the alternative treatments discussed
- Potential outcome(s) of treatment
- Risks involved if treatment is refused
- An opportunity for the patient to ask questions and receive answers

It is difficult to completely inform the patient of all potential risks. However, there should be a reasonable attempt made on the part of the provider so that the patient can make an informed decision. The informed consent is for only those procedures to which the patient consented. This principle comes from a medical case that occurred in the early 20th century. A woman consented to have an operation on her diseased right ear. While under anesthesia, the physician determined the left ear was more seriously diseased than the right and operated without consent. The operation was successful. However, the patient was never awakened and permission never granted. The plaintiff sued for battery and won (*Mohr v Williams*, 104 N.W. 12, [Minn. 1905]). The case highlights the importance that dental providers should only complete procedures consented to by the patient. A dental provider that received consent to place sealants on specific teeth cannot choose to provide the treatment on teeth for which the parent did not consent. Informed consent should be documented, either by using a form that lists the elements described or documenting consent in the progress notes. It is advised that the patient sign and date the informed consent, as should a witness. Written documentation, such as a signed informed consent, documents information that is useful if a lawsuit occurs. The informed consent provides a source of reference and assists the dental provider in proving that a duty to obtain informed consent was met.

There are exceptions to obtaining informed consent unique to each state. The more general exceptions include the following:

- Emergency treatment.
- Not informing the patient about commonly known risks. One should be cautious because what is “known” to the dental professional is not necessarily the patient’s understanding.
- The risk is too minor or remote.
- The disclosure of risks may be more detrimental to the patient’s well-being, sometimes referred to as therapeutic privilege.
- The risk is not known to the profession.
- The patients indicate they are waiving their right to know. The provider should be cautious and obtain informed refusal if the patients indicate they do not want an explanation of the procedures, risks, and alternatives.
- Regular explanation of a procedure. If a regular explanation is always used, such as the reason for root planing and scaling or use of an ultrasonic scaler, it is advisable to have the explanation documented in an office or clinic manual. Caution is advised against relying on the “regular” explanation for failing to obtain consent because the informed consent process is tailored to the patient’s situation.

A consent form should comply with state law. Handing the form to the patient is not advised; rather orally discussing the information and obtaining a written consent is recommended. If a preprinted form is used, notations should be made on the form to show topics or aspects of informed consent, which were discussed. The notation can be initials of the patient or provider, handwritten explanations or additions, checkmarks, words added or a line drawn through words. In most jurisdictions, only a dentist can obtain informed consent. Concurrently, in some states, dental hygienists are allowed to treat patients of record without a dentist on the premises. Dental hygienists provide treatment that may include administration of local anesthetic and periodontal and ultrasonic instrumentation. There are treatment justifications and benefits for all procedures. There are also risks with each procedure. Risks

for anesthesia can be sensitivity, temporary or permanent paresthesia, or an allergic reaction. The risks for periodontal treatment can include failure of the treatment, infection, periodontal abscess, and sensitivity.

If state law does not allow the dental hygienist or dental assistant to obtain consent, the dental hygienist or dental assistant may want to develop a protocol in which the information included in an informed consent is reviewed and discussed with the patient. A notation in the chart could indicate the content of the discussion and record that the patient understood what was to occur during the appointment. The provider could also record questions posed by the patient, as well as responses. The information can be documented in a precise manner; however, it should be clearly recorded that the patient was informed of the planned treatment and accepted. Dental providers treating compromised patients, including the mentally impaired or elderly patients with compromised ability, must strive with other members of the dental team to obtain consent. For those patients with compromised ability, the patient record should clearly document who can provide consent—a legal guardian, a spouse, a divorced parent, or an adult child. If an individual indicates legal right to give consent for another’s treatment, such as a biologic parent in the case of a child of divorced parents, it is advisable to request a copy of documentation, stating who is legally allowed to consent to treatment. Frequently, grandparents, indicating they have responsibility for a child, accompany children scheduled for an appointment. The child cannot give consent because of minor status; the provider should request documentation to confirm the relationship of the grandparents and determine if the grandparents have legal rights. A frequent dilemma is the minor child that is left alone for a scheduled appointment by a parent or guardian. The dental provider, seeking to obtain consent, finds the parent unavailable. Dental services, especially those with potential risks involved, should not be provided without consent. One may consider telephone consent, with the increasing number of

cell phones available, or if the parent is at work. However, if telephone consent is obtained, it is suggested that a second person “witness” the consent by also speaking to the person granting the consent. The circumstances for obtaining consent by phone should be recorded, including the date, time, and witness. Other instances in which consent by telephone occurs may be when a child has been brought to a dental clinic by a caregiver, teacher, or friend. If a patient is mentally compromised but legally allowed to consent to treatment, the provider should attempt to explain the procedures in a language the patient understands, allow the patients to repeat what they comprehend, and record the interaction.

Providers in public health settings are faced with challenges in obtaining consent from populations that represent diverse backgrounds, in their language, health practices, and culturally accepted interpersonal communication styles. The individuals seeking care, both in private practice and public health settings speak multiple languages, with English frequently not being the primary language spoken at home. If possible, bilingual staff should be employed within a particular setting. Practitioners should be cautious not to rely on English speaking relatives to obtain health related information or consent. Having a youngster translate for an adult may create situations where the information being provided or obtained is not accurate. Or, there may be cultural limitations. For example, a male child may not be able to ask a female parent certain “personal questions.” Additionally, literacy remains a challenge for many patients. Individuals with limited literacy come from all segments of the population, but are disproportionately represented in populations served in public health settings. It is recommended that informed consent forms should be written at the sixth to eighth grade readability level. There are online tools available to assess the reading level material. Translation of forms to a particular language is also an option, and should include health history forms as well. There remains a challenge to get informed consent, and providers and public programs should take steps to provide

a reasonable effort to obtain informed consent. The dental provider must evaluate the necessary procedures and the risk of harm.

Challenges occur for dental hygienists in all practice settings. An employer or a supervising dentist may request that a dental hygienist compromise assessment or treatment protocol. An employer dentist may request that the dental hygienist should spend less time with a patient whose oral health care is paid for by a state welfare agency because the compensation level is considered (by the dentist) to be below usual, customary, and reasonable fees. The dental hygienist may provide substandard care, not appropriately root planing or educating the patient and, therefore, not fulfilling a standard of care.

A dental provider faces other challenges in certain work settings. Parents or guardians are not always committed to optimum oral health care and may be uncooperative in getting the patient to an appointment, reinforcing preventive care, or agreeing to treatment. In a situation in which either the patient or the patient’s parent or guardian refuses recommended treatment, the dental provider should get a signed informed refusal.

An **informed refusal** is documentation that the recommended treatment is refused. This type of written documentation protects the provider from subsequent allegations of negligence. Informed refusal is an outgrowth of informed consent. A dental hygienist conducts an intraoral examination and identifies a lesion that the dentist agrees needs to be referred. The patient refuses to go for the biopsy and later develops oral cancer and subsequently dies. The dentist could be sued for failing to inform the patient of the consequences of refusal for a biopsy. An informed refusal form or documentation is similar to informed consent. The informed refusal should document the recommended procedure (e.g., referral to a periodontist because of advanced periodontitis). The general and oral health risks to the procedure being refused should be documented. The refusal should document any patient questions and the responses made and include dated signatures of the dentist,

the patient, and a witness. Another form of informed refusal is a patient statement in the chart, indicating refusal of a recommendation. For example:

I, Connor Burton, refuse to have a complete set of radiographs (x-rays) taken by the dentist/dental hygienist. Dr. Alex has informed me that by refusing the x-rays I am not allowing her to appropriately evaluate my oral health status and plan my dental treatment. I understand the risks are that Dr. Alex will not be able to determine if I have cavities, gum disease, or other problems, such as cancer in my mouth. I also understand that she may not be able to treat my disease, resulting in my condition becoming worse. I refuse the x-rays, understanding the risks to my oral and general health.

Signed,

Connor Burton

March 21, 2011

Witness Signature _____

A written statement, such as the one presented, either typewritten or in the patient's handwriting, is clear documentation that the patient refused a recommendation and is aware of the risks of the refusal. In certain situations, when patients are asked to sign such a statement, they change their decision and cooperate. Another term used for informed refusal is "against dental advice," or similar language. The purpose of informed consent and refusal documentation is to maintain a record that shows the provider attempted to meet their duty to inform and that the patient either consented or refused.

Risk Management

A basic understanding of civil law related to contract and tort law is important to all dental professionals. The legal principles assist in guiding the dental team in developing protocols for patient care, working as a team, and preventing the potential for litigation. In addition to understanding the concepts to reduce the risks for allegations of negligence, risk management techniques can be incorporated in daily activities and as part of an approach to the management

of a clinic, research study, or public program. Risk management includes assessing licensed and unlicensed office personnel, office protocols, record keeping and storage, facilities, and personal interactions to determine if there are at-risk practices. If there are activities or actions that place the office at risk for a potential lawsuit or allegation of failing to comply with a state or local ordinance or regulation, steps should be taken to remedy the risk. Depending on the identified risk, the actions could be as simple as updating an outdated health history or more difficult, such as terminating the employment of an unprofessional or incompetent employee. Additional risk management techniques important to dental providers in community-based clinical settings, research studies, or public programs are as follows:

- Clear, concise, and accurate documentation. An office manual should outline a framework for documenting treatment notes, patient cancellations, informed consent, informed refusal, and telephone conversations with patients or other health professionals. The recommended documentation should comply with state law requirements. If acronyms are used, such as WNL (within normal limits) or S/RP (scaling and root planing), office manual descriptions should provide a definition. This is critical in multistaff employment environments, ensuring that all providers can understand the records and what has occurred. Staff in-service and reviews of record keeping protocols are also recommended on a regular basis.
- Personnel should be currently licensed and credentialing checks should occur at initial employment and throughout the term of employment, including requests for educational credentials, background checks, CPR certification, specialty board certification, current licensure documentation, and evidence of continuing education activities. If appropriate, peer review can allow opportunities for consistency in skill and treatment protocols.
- Clear written and oral communication. The setting for the provision of dental care may include a diverse staff and patient population.

Sensitivity to cultural differences, language, health beliefs, and practices is important. If a particular ethnic patient population is represented in a practice, health history forms, informed consent and refusal forms, post-operative forms, and other patient-focused forms should be translated. Bilingual staff is also recommended.

- Awareness of state practice acts, state statutes, public health codes and local ordinances that impact facilities, records, supervision requirements, and reporting requirements (for infectious diseases) is important. It is critical that all members of the dental team are familiar with the scope of practice allowed by the state dental practice act. Copies of pertinent materials can be on file or a listing of web sites where information can be obtained should be provided in an area accessed by all personnel.
- Knowledge of federal and state laws impacting record keeping and patient confidentiality and patient safety, including Occupational Safety and Health Administration (OSHA) and Health Insurance Portability and Accountability Act of 1996 (HIPAA) regulations.

Administrative Law

Federal administrative law focuses on the exercise of government authority by the executive branch and its agencies. These agencies are created by Congress through “enabling legislation,” and are authorized to promulgate regulations that have the same force as statutory law. Federal agencies have steadily grown in number and importance in the United States, and affect a wide variety of social issues, such as telecommunications, the financial market, and racial discrimination.

Administrative law is a body of law created by administrative agencies in the form of rules, regulations, orders, and decisions. State governments are responsible for protecting the health, safety, and welfare of their citizens. In most states, the legislative branch of government enacts the state’s dental practice act. The state dental practice act can be a single law or

compilation of laws that regulate the practice of dentistry and dental hygiene. Other laws may exist in a state within public health law, child protection laws, elder rights and protections, occupational safety, informed consent, health care fraud, and education and training requirements for relicensure. For example, the **dental practice act** may indicate a minimum number of clock hours of continuing education for license renewal, whereas a public health law requires all health care professionals to participate in domestic and child abuse training. Dental providers must be aware of the scope of the laws that impact their ability to practice and interact with patients. In certain states, the ability for a dental hygienist to practice in a clinic or health care delivery setting without a dentist on the premises required special laws to be promulgated. The language allowing specific practice rights may not appear in the dental practice act but in other legislation, such as a state senate bill. The type of supervision required to practice dental hygiene varies from state to state, by definition of dental hygiene scope of practice and, in some instances, the location of the practice. The definitions are state specific and, although similar terms are used, the descriptions may also vary (i.e., direct supervision may mean slightly different practices in different states). Specific types of supervision requirements are found in most states.

Direct supervision usually requires examination and diagnosis by a licensed dentist, for a patient of record. The dentist may delegate or authorize the dental hygienist to complete the procedure. The dentist needs to be on the premises and may be required to examine the patient before and after the procedure. Direct supervision requirements also apply to many tasks performed by a dental assistant.

The terms **assignment**, **indirect supervision**, and **general supervision** are also used to describe supervision requirements. It is imperative that all members of the dental team read dental practice acts and pertinent state law carefully to determine the requirements for supervision of dental hygienists and dental assistants. In one state, indirect supervision is defined as requiring a diagnosis of a patient’s condition

and authorization by a dentist to complete a procedure, with the dentist on the premises. In another state, this same description may be defined as general supervision. Assignment, or a similar term, is used in some states to describe a type of supervision in which the dental hygienist is allowed to treat a patient of record without the dentist on the premises. However, a patient of record is defined as someone who has been examined and diagnosed by a licensed dentist and whose treatment the dentist has planned. The dentist then assigns the care to the dental hygienist to complete.

To increase access to care for underserved populations, some states allow **unsupervised practice**, including Colorado and Maine. The practice status allows an individual to root plane and scale, perform curettage, apply preventive measures such as fluorides, assess the patient, record patient data, and administer topical anesthetic. Under Colorado regulations, unsupervised practice can be provided by a licensed dentist or dental hygienist without the supervision of a licensed dentist. Another 19 states allow dental hygienists to practice with varying forms of unsupervised practice or less restrictive supervision, though state laws may restrict the setting, the hygiene services, or the duration of time for which dental hygiene care can be provided.

Collaborative practice is an emerging practice model in which dental hygienists strive to prevent and treat oral disease through the provision of educational, assessment, preventive, clinical, and other therapeutic services. In this model, practiced by certain dental hygienists in New Mexico, the dental hygienist works in collaboration with the dentist but without general supervision, as defined by New Mexico law. Dental hygienists choosing to practice in traditional and nontraditional settings should be familiar with the law and their rights and responsibilities. Public health administrators also should be aware of effective and legal strategies to use staff.

For the implementation of a law to occur, the executive branch of the government is responsible. Within the executive branch are departments and agencies of the state government,

including the Department of Consumer and Industry Services and the Secretary of State. To implement statutory law, specific requirements are developed (rules). Dental professionals are regulated by a governing body (e.g., the Board of Dentistry or State Dental Commission). The rule-making body allows a public forum and process to get input and make changes in the rules for a profession. State boards of dentistry have responsibilities that may include definitions of supervisory requirements and categories, such as direct or general supervision of dental hygienists; issuing, renewing, and revoking licenses; protocol for disciplinary allegations; and outlining of scope of practice for dental assistants, expanded duties assistants, and dental hygienists.

The dental practice act, or other legislation, may promote or deter the role of the dental hygienists in providing services to populations in need. Certain states, for example, have strict rules governing the supervision of dental hygienists by a licensed dentist on site at all times. This may limit access to care in geographic locations where there are not enough dentists in practice or in locations where dentists prefer not to practice. If a dental hygienist chooses to provide care without appropriate supervision, the dental hygienist would be violating the state practice act and may be subject to disciplinary actions. The challenge of unmet dental need is a frequently encountered scenario. Many state dental hygiene associations have taken measures to try to change laws to permit dental hygienists to practice in public or dental health clinics to provide access to preventive services for underserved populations. The success to change the laws in different states has varied. Dental hygienists have collaborated with other health professionals, public health agencies, and consumer groups to promote changes in state regulations. This has required knowledge about how an idea for change becomes a change or addition to the law. Knowledge about the legislative process is an important skill for dental hygienists and others interested in making changes to improve access to care and address other issues related to community service and education.

CREATION OF LAWS

Dental professionals active in community-based education or service frequently take on the additional role of a change agent. A dental hygienist, or group of dental or other professionals, determines that a law needs to be introduced or changed. This new law or change in law may be to expand the roles and responsibilities of a dental hygienist, such as allowing the administration of local anesthesia. Or, the change may be

in reallocation of funds for dental reimbursement by modifying Medicaid requirements. The federal and state process for the introduction of a bill to become a law is similar, although there are variations state by state. Figure 17-1 provides a diagram of how a bill becomes a Federal law. State governments follow a similar process. States may vary as to the roles of the state assembly or legislature, but the process follows a core of basic steps. The bill is introduced, or started, on either the house/assembly or senate side of the state

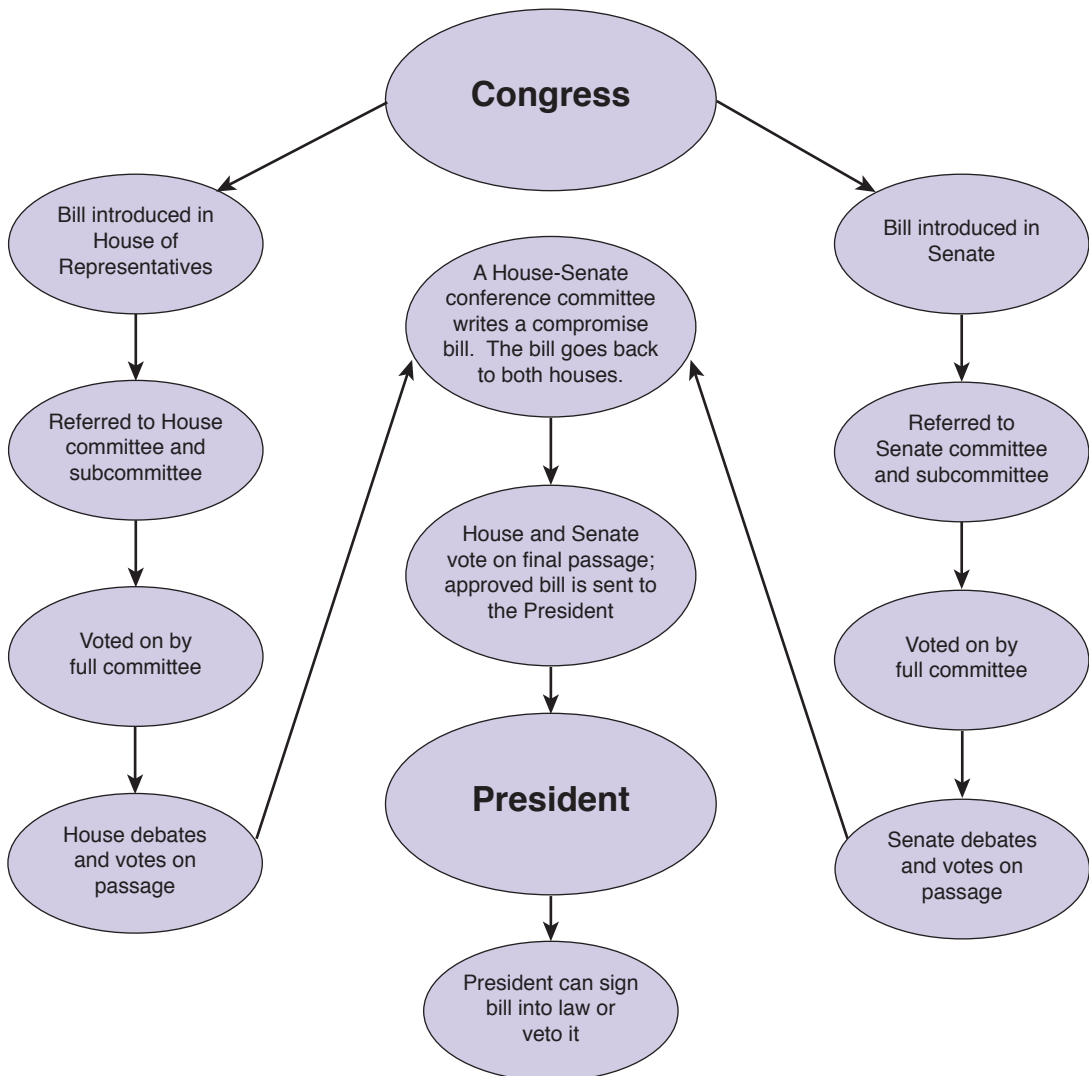


FIGURE 17-1 How a bill becomes a law.

legislature. Any legislator in the senate or house/assembly can introduce a bill. In some states, dental professionals have worked with a supportive senator or representative to have a specific bill introduced. After each bill is introduced, it is sent to an appropriate committee. Four things can occur—the committee reviewing the bill:

1. Agrees with it in its original form and, if it was proposed on the house/assembly side, it is sent to the senate side.
2. Modifies the bill after listening to public comment and/or expert testimony.
3. Allows the bill to “die” in committee. It is then returned to the author. The individual who proposed the bill can either rewrite and reintroduce the bill or drop it.
4. Can “pigeonhole” the bill if it appears extreme—it will remain there until it is reconsidered.

If the committee has rewritten or modified the bill, it will come back to the house/assembly floor where all members of the house/assembly listen to the bill as it is read, sometimes line-by-line. The house/assembly members present the pros and cons and debate the bill. Each house/assembly member is asked to vote. If the bill passes the house/assembly side of the state legislature, it goes to the senate where the same process occurs. In certain states, the legislation must “age” for a short period (e.g., 3 days) prior to being sent to the other legislative body. If it successfully passes senate debate and discussion, it is forwarded to the governor. If the governor signs a bill, it is law. If the governor vetoes the bill, it returns to either the house/assembly or senate to be voted on again. Usually, it must receive a two-third majority vote in both houses to become law and override a veto. The U.S. Congress would follow a similar pattern for a bill introduction, such as prescription drug coverage or campaign finance reform. If the U.S. President signs a proposed bill, it becomes public law.

Public Law

Public or federal laws impact dental professionals personally and professionally. Public or fed-

eral laws protect individuals as employees, offer guidance to employers, and guarantee certain rights to groups of individuals. Dental hygienists have roles of both employee and employer. The federal laws may only apply to situations in which a minimum number of individuals are employed.

The employment relationship is one of two types: (i) at-will, with indefinite duration; or (ii) contractual, with definite duration. The employment at will concept governs the employment relationship, meaning the employment takes place at the will of either the employer or employee. The employment can be terminated at any time for no reason. Similarly, the employee can quit at any time. Many dental professionals have an at-will employment situation. The exception is when there is a specific employment contract between the employer and employee that outlines the duration and terms of employment. The protocol or reasons for termination are outlined in the contract. Unfortunately, termination for certain individuals is based on a particular status or characteristic. Federal legislation was initiated and passed to protect certain classes of individuals.

The following are brief descriptions of laws important to dental providers, researchers, and public health program managers for individual protection against discrimination or loss of federally mandated rights.

1. Employment Discrimination Laws

- Title VII of the Civil Rights Act of 1964 prohibits discrimination in hiring and discharge and in employment compensation, terms, conditions, and privileges because of an individual's race, color, religion, sex, or national origin. Title VII covers employers of 15 or more employees, working at least 20 weeks of the year. Title VII created the U.S. Equal Employment Opportunity Commission (EEOC). The EEOC enforces Title VII provisions. A prerequisite of a court action under Title VII is filing a complaint with the EEOC within 180 days or, in a deferral state, 300 days. Title VI of the Civil Rights Act of 1964 forbids discrimination in all aspects of patient care in institutions that receive federal financial

assistance, such as Medicare and Medicaid. Title VII also makes sexual harassment a form of unwelcome sexual discrimination.

- Age Discrimination in Employment Act of 1967 (ADEA) prohibits discrimination based on age against any employee or applicant for employment that is at least 40 years of age and applies to employment settings with 20 or more employees.
- Rehabilitation Act of 1973 applies to employers with federal contracts of \$2500 or greater. It prohibits discrimination in employment practices based on physical or mental disabilities. The act also requires federal contractors to implement an affirmative action plan in hiring and promoting disabled employees.
- Americans with Disabilities Act of 1990 impacts employers with 15 or more employees working at least 20 hours a week. Titles I and II ban discrimination against disabled persons in the workplace, mandate equal access for the disabled to certain public facilities, and require commercial firms to make existing facilities and grounds accessible to the disabled. Patients are also protected under this statute. Title III of the act prohibits discrimination based on disability and indicates patients should receive all goods, services, facilities, and accommodations of any privately owned place of public accommodation, including hospitals and professional offices. Three categories of persons are considered disabled under this law:
 - a. A person who has a physical or mental impairment that substantially limits one or more of the major activities of that person.
 - b. A person who has a record of such impairment.
 - c. A person who, although not actually being disabled is regarded as disabled.
- 1976 Pregnancy Discrimination Act is an amendment to Title VII of the Civil Rights Act that makes it illegal to fire an employee based on pregnancy, childbirth, or related medical conditions. An employer cannot force a woman to quit

her job because she is pregnant and a woman cannot lose her job because she had an abortion. Pregnancy must be covered in employer's medical plans similar to any other medical condition.

2. Employee Safety and Health

- The OSHA act of 1970 protects worker safety and prohibits firing an employee for reporting workplace safety hazards or violations. OSHA regulations preempt all state and local regulations regarding employee safety and health. In 1991, OSHA developed rules to protect health care workers from bloodborne disease, called the OSHA Occupational Exposure to Bloodborne Pathogens Standards. There are significant penalties if an employer violates the standards.
- Consolidated Omnibus Budget Reconciliation Act requires that an employer with 20 or more employees must provide extended health care insurance for as long as 18 months following termination of employment usually, but not always at the expense of the employer.
- Drug Free Workplace Act of 1988 requires an employer contracting to provide goods or services to the federal government to certify that they maintain a drug-free workplace.

3. Wage and Benefits

- Equal Pay Act of 1963 is an amendment to the Fair Labor Standard Act that requires equal pay for men and women doing equal work. Equal work is work that requires equal skill, responsibility, and effort under the same or similar working conditions.
- Family and Medical Leave Act of 1981 applies to public and private employers with 50 or more employees. This act allows employees to take an unpaid leave for up to 12 weeks if they have been employed for more than 1 year and worked for at least 1,250 hours. Leave is allowed for maternity, adoption, or for caring for ill family members. Individuals may be allowed leave to provide:
 - a. care for ill and injured children younger than 18.

- b. care for adult children who cannot take care of themselves because of physical or mental disability.
- c. care for a son or daughter, including biologic, adopted, or foster children; stepchildren; or legal wards.
- d. for personal health problems (physical or psychological) that affect employee, spouse, or parents (in-laws are not included in the definition of parents and unmarried partners are excluded).

Federal laws do not only focus on employment protection and discrimination. The Health Care Quality Improvement Act of 1986 was a federal statute passed to improve the quality of medical care nationwide. One provision that came from this act was the **National Practitioner Data Bank (NPDB)**,² a repository of all payments made on behalf of physicians and dentists in connection with malpractice settlements or judgments and adverse peer review actions against licenses. The law requires that medical malpractice information must be reported so that the information is available to state licensure boards and certain professional societies. The purpose was to improve the quality of health care by encouraging licensing boards to identify and discipline practitioners who engage in unprofessional behavior and restrict the ability of incompetent providers to move from state to state without knowledge of previous history.

The HIPAA has three primary purposes:

- (i) to help employees keep continuous health care coverage for themselves and their dependents if they leave one job for another; (ii) to protect confidential medical information from unauthorized disclosure and/or use; and (iii) help curb the rising cost of fraud and abuse through streamlining of codes and billing procedures.

DATA BANKS

Legislation resulted in the creation of the NPDB.² The legislation was enacted because the U.S. Congress wanted to improve the quality of medical care by providing incentive and protection for physicians, dentists, and other health

care providers to engage in effective professional peer review. The intent of Title IV of Public Law 99-660, under the Health Care Quality Improvement Act of 1986, often referred to as the NPDB, was to encourage State licensing boards, hospitals, and other health care entities to identify and discipline those that are involved in unprofessional behavior; to restrict the ability of incompetent health care providers to move from State to State without disclosure or discovery of previous medical malpractice and adverse action history. Adverse actions can involve licensure, clinical privileges, and professional society memberships. It is described as an alert or flagging system. The information reported is considered confidential. The guidelines define those that are eligible to obtain information, for example state licensing boards or health care entities, in order to evaluate a potential employee.

A second data bank of interest is the Healthcare Integrity and Protection Data Bank (HIPDB).² The Secretary of the U.S. Department of Health and Human Services, acting through the Office of Inspector General, was directed by the Health Insurance Portability and Accountability Act of 1996 to create the HIPDB to combat fraud and abuse in health insurance and health care delivery. Health care fraud burdens the nation with enormous financial costs and threatens the quality of health care and patient safety. The HIPDB is intended to augment, not replace, traditional forms of review and investigation, serving as an important supplement to a careful review of a practitioner's, provider's, or supplier's past actions. Table 17-1 highlights important information comparing the two acts and outlines what types of individuals and agencies can report violations.

State Law

State laws may be similar to federal laws and, in certain instances, stricter. A state law can never conflict with a federal or public law. State laws are also designed to protect the rights of employers and employees. State modified laws related to employment discrimination may add additional factors that cannot be used for discriminatory purposes, such as height, weight,

TABLE 17-1

DATA BANKS AT A GLANCE	
NPDB	HIPDB
The National Practitioner Data Bank was established under Title IV of Public Law 99-660, <i>the Health Care Quality Improvement Act of 1986</i> . NPDB is an information clearinghouse to collect and release information related to the professional competence and conduct of physicians, dentists, and other health care practitioners.	The Healthcare Integrity and Protection Data Bank was established under section 1128E of <i>the Social Security Act</i> as added by Section 221(A) of the <i>Health Insurance Portability and Accountability Act of 1996</i> . HIPDB was implemented to combat fraud and abuse in health insurance and health care delivery and to promote quality care. HIPDB alerts users that a more comprehensive review of past actions by a practitioner, provider or supplier may be prudent.
WHO REPORTS?	
• Medical malpractice payers • Medical/Dental State Licensing Boards • Hospitals and other health care entities • Professional societies with formal peer review • HHS Office of Inspector General • U.S. Drug Enforcement Administration	• Federal and State Government agencies • Health plans
WHAT INFORMATION IS AVAILABLE?	
• Medical malpractice payments (all health care practitioners) • Adverse actions—based on reasons relating to professional competency and conduct (primarily physicians/dentists) • Licensing actions: revocation, suspension, censure, reprimand, probation, surrender, denial of an application for renewal of license, and withdrawal of an application for renewal of license (reported as a voluntary surrender) • Clinical privileges actions • Professional society membership actions • Medicare and Medicaid exclusions (all health care practitioners) • U.S. Drug Enforcement Administration actions (all health care practitioners)	• Licensing and certification actions • Revocation, suspension, censure, reprimand, probation • Any other loss of license—or right to apply for or renew—a license of the provider, supplier, or practitioner, whether by voluntary surrender, non-renewal, or otherwise • Any negative action or finding by a Federal or State licensing and certification agency that is publicly available information • Civil judgments (health care related) • Criminal convictions (health care related) • Exclusions from Federal or State health care programs • Other adjudicated actions or decisions (formal or official actions, availability of due process mechanism and based on acts or omissions that affect or could affect the payment, provision, or delivery of a health care item or service)
WHO CAN QUERY?	
• Hospitals • Other health care entities with formal peer review • Professional societies with formal peer review • Boards of medical/dental examiners and other health care practitioner State Licensing Boards • Plaintiffs' attorneys or plaintiffs representing themselves (limited) • Health care practitioners (self-query) • Researchers (statistical data only)	• Federal and State Government agencies • Health plans • Health care practitioners/providers/suppliers (self-query) • Researchers (statistical data only)

From http://www.npdb.com/pubs/Data_Banks_at_a_Glance.pdf

marital status, or sexual orientation. A state law may broaden the definition as compared with federal law (e.g., the term disability would include a larger scope of conditions). State laws may define the **statute of limitations** for specific legal actions. The statute of limitations is the length of time during which a legal action must be taken and can be a state law or part of a statute. Limitations are put on the ability to collect, retention of medical records, medical or dental malpractice claims, and damages for child sexual abuse. The statute of limitations for filing a negligence suit against a health professional varies by state. The range of time may be from 1 to 6 years, with 2 years the most common. Some states define the start of the limitation period from the time the negligent act was alleged to occur; in some states, from the time it was discovered or should have been discovered or the date the provider–patient relationship ended. In addition, the statutory period in certain states is modified for minors or other categories of patients, such as the imprisoned or legally insane. Dental providers should be familiar with the laws in their state. State laws may also require specific continuing education courses for health care providers. A state law may impose a requirement on a health care provider in a specific setting, such as an institution or hospital, to obtain testing for specific diseases, such as the tuberculin test. A state may also have language in a statute that forbids a health care provider to treat a relative or person with whom there is a personal relationship.

State laws protect individuals but also may provide guidelines limiting individuals in their actions. Dental providers may be employed by a particular state agency to staff a clinic or community center. State law may specifically state that an employee cannot, for example, while on the job during working hours, promote or oppose political committees, elections, positions, candidates, or ballots. Or a supervisor may not ask an employee to participate in a political activity. There is also frequently language that indicates “off hours” activity of a political nature is allowed, but an employee should not feel compelled by a supervisor to participate in a particular activity.

A TOOLBOX FOR THE ORAL HEALTH CARE PROVIDER

An oral health care provider who treats patients evaluates each patient’s oral health status and plans the treatment specific to the patient’s needs. The provider uses skills and knowledge acquired through education, both formal and lifelong learning; experience; and networking with colleagues. The provider picks which “tools” are needed to complete a task, whether a dental instrument, an oral hygiene index, or a consultation with a dental or health professional. The dental hygienist in a community setting may have various roles, including provider, manager, negotiator, change agent, advocate, researcher, record keeper, or quality controller. The dental hygienist or dental provider relies on the public health model or approach that includes assessment, diagnosis, planning, implementation, evaluation, and documentation with education and financial considerations a common aspect of all phases. There must be an understanding of the legal principles and local, state, and federal laws that apply to the circumstances in that individual’s toolbox.

A public health professional should rely on a toolbox that includes knowledge and skills important to the provider to fulfill the roles and responsibilities of a particular position. The toolbox should include personal, professional, legal, and ethical tools that can be accessed and used when needed.

The following are suggested tools to include in a dental public health provider’s toolbox:

1. Personal

- Ability to recognize deficiencies and seek assistance or opportunities to remedy skill or knowledge weaknesses. Example: cultural knowledge acquisition about a particular ethnic or religious population
- Negotiating skills
- Conflict resolution strategies and how to use them
- Commitment to lifelong learning
- Ability to access information about rules, regulations, practice acts, and other statutory information pertinent to public health

settings, state or local agencies, federal agencies or groups, and oral health care providers. Sources may include libraries, telephone numbers, web sites, professional associations, online archives, or educational institutions

2. Professional

- Awareness of local and state government priorities focused on oral health care, including access issues and financing mechanisms
- A database of names and office locations and e-mail addresses for local and state politicians and their political agendas
- Names and goals of state political action groups (PACS) or other lobbying groups interested in relevant issues, including general health, oral health, citizen well-being, sports injury safety, and smoking cessation
- Advocacy skills
- Knowledge of potential allies or resources, including major health professional advocacy groups or associations in the city, state, or region (e.g., nursing and medical societies, visiting nurse associations, migrant services, ethnically or religiously based coalitions)
- List of state colleges and universities with dental, dental hygiene, allied health, and health education programs
- Knowledge of the local or state public health system, with an emphasis on the dental division or department and its agenda, personnel, budget, and annual or strategic plan
- The names of individuals in the local and state dental and specialty dental societies responsible for community liaison, community service planning, grant funding, and political networking
- Copies of the latest public health codes and dental practice acts and/or web sites for access
- Advocacy skills, including the ability to access information using listserv memberships, local publications, attendance at annual meetings of health professions groups, and subscriptions to online or mailed newsletters

- Contributions to political allies or volunteer time for political campaigns to develop a network for support

Summary

Oral health care providers practice within ethical and legal guidelines to protect themselves and the patients and communities they serve. A basic foundation in legal principles, including contract and tort law, will protect the dental provider in their day-to-day activities and decisions. Knowledge about state and federal laws that impact the employment settings and outline the rights and responsibilities of employers and employees contributes to a professional employment situation and reduces the risks of allegations of unprofessional conduct, discrimination, or harassment. The community-based dental provider must also be knowledgeable about changing the legal system to resolve issues impacting access to care. Awareness of the legislative process assists the dental hygienist and other members of the dental team to appropriately resolve issues in a professional, yet significant, manner. Dental providers should use the legal concepts and federal and state laws to protect their rights, and those of the patients and communities they serve, as providers and as citizens.

Learning Activities

1. Obtain a current copy of the dental practice act for the state where you received your education and also a copy of a dental practice act from another state. Compare and contrast the acts. What are the similarities? What are the differences?
2. Identify a patient situation in which it was apparent that there were irreconcilable differences between the provider and the patient regarding treatment. Draft a letter indicating that the relationship is ending, including the key elements to prevent allegations of abandonment.

3. Contact the state dental hygiene association or dental association. Invite the lobbyists to a student association or component meeting to discuss their role in advocating for oral health issues on the state level.
4. Identify current issues impacting on the public's health in your area or state. Identify your state representative. Draft a letter advocating for a particular cause, bill or issue important to oral health.
5. Review the list of contractual responsibilities that outlines the duties of the provider to the patient. Divide the students into two groups. Have one group give an example of how a violation of the responsibility could occur and have one group discuss strategies that could prevent the violation from occurring.
6. Individually, or as a group, identify a federal or state law or laws that you want additional information for or one that is unknown to you. Log on to the web site that provides information about the law. Prepare a brief report for a presentation. Discuss how the law impacts dental hygiene practice. Compile each report into a packet and copy and distribute to all classmates to use as a future reference.
7. Identify procedures or treatments commonly provided for patients in clinical settings. Using the informed consent criteria, identify the procedure, possible risks and benefits, alternatives, and other information necessary to obtain an informed consent.
8. Identify a procedure, or procedures, that patients could refuse. Draft an informed refusal statement for the patient to sign. Or, role play a situation in which a patient is declining a recommended treatment and the response of the provider.
9. Draft a dental hygiene office manual. As a group, identify a table of contents, including (but not limited to) topics such as employee rights and responsibilities; sexual harassment policy; termination notice guidelines; policies and procedures; dental hygiene record keeping guidelines; commonly used acronyms, with descriptions; sample termination letters; and other information that all dental hygiene team members should know. Assign portions to small groups within the class or component society. Review the drafts and compile.
10. Create a risk management audit form for a dental clinic. Categories to consider evaluating can include personnel, equipment, records, security, and policies and procedures. List specific areas that will be reviewed. Conduct a mock audit.
11. Obtain a copy of a state senate or house/assembly bill as a prototype. Draft a bill for submission to your state legislature. Identify a topic or issue that would impact on oral health status within your state. For example, a no-smoking policy in all restaurants or a mandatory bike helmet safety law. Divide the class into groups and then report the different "bills" that were proposed. If time allows, select certain students to present both sides of the bill (in favor and opposed) and listen to the arguments. Vote on the bill.
12. Obtain a copy of the Title VII of the Civil Rights Act of 1964 and the specific state law that protects civil rights. Compare and contrast the language found in the federal and state law. Is the state law stricter or more comprehensive and, if so, how?
13. Determine if your state has specific guidelines about medical records and the transfer of records from one medical/dental facility to another.
14. Invite an attorney that represents dental professionals in malpractice litigation to speak to a class or component society.
15. Invite a panel of oral health care providers that are employed in community-based or public health settings. Ask them to describe the ethical and legal challenges they face in daily practice.
16. Based on the community of practice or employment, invite a representative group of patients that represent ethnic and cultural diversity. Discuss health beliefs. Following the presentation, review the current health history form and update based on the knowl-

edge gained. If individuals cannot be invited to participate, research the predominant ethnic or cultural groups represented in the community. Focus on health beliefs and practices. Develop a health history form and informed consent form that reflects belief, language and culture.

Resources

- Beemsterboer PL. *Ethics and Law in Dental Hygiene*. Philadelphia, PA: WB Saunders, 2001
- Council on Dental Insurance. Informed consent: a risk management view. *J Am Dent Assoc* 1987;115:630–635
- Garner BA. *Black's Law Dictionary*. 8th ed. St. Paul, MN: West Group, 2004
- Pollack BR. *Law and Risk Management in Dental Practice*. Chicago, IL: Quintessence, 2002

Review Questions

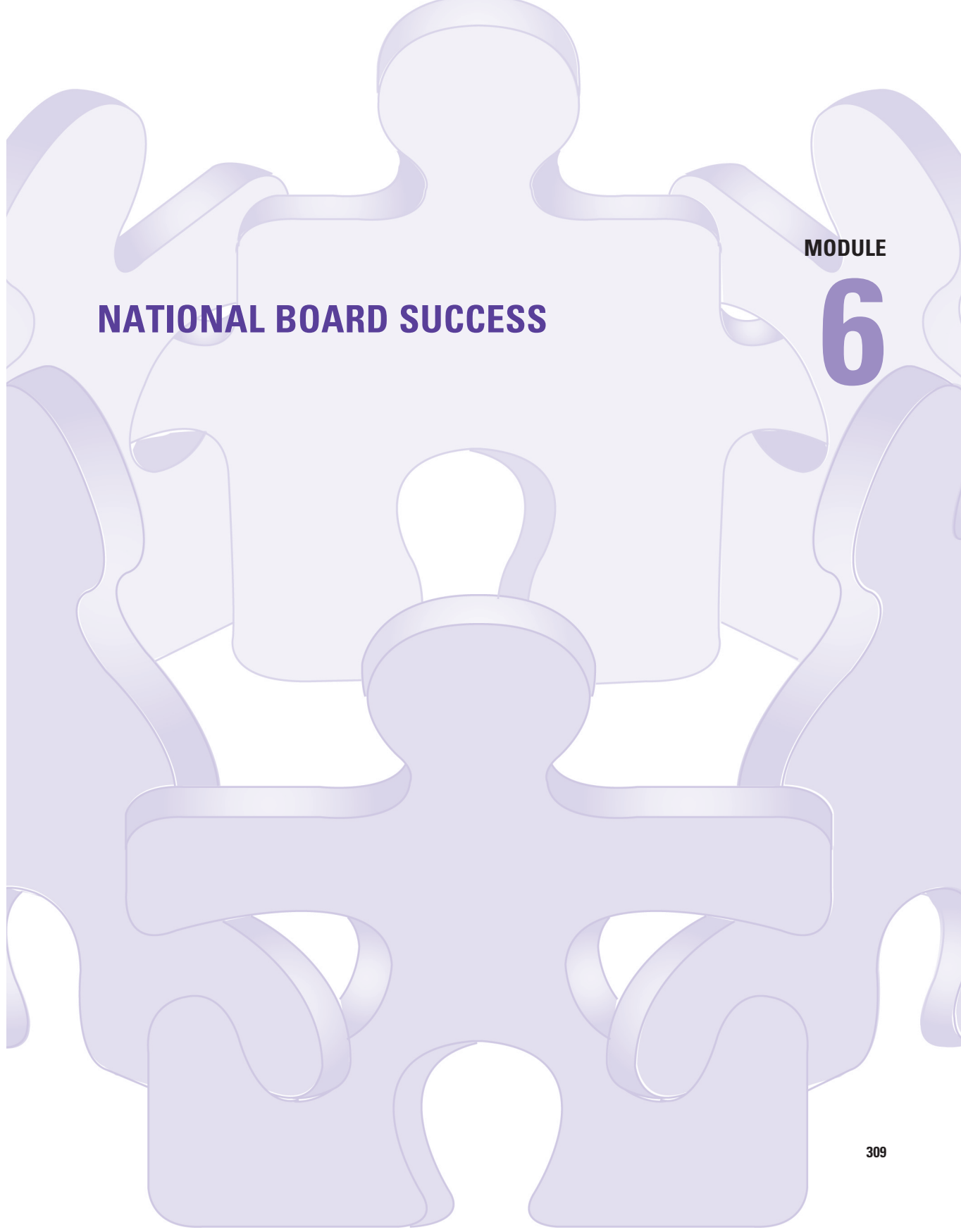
A patient presenting to the clinic completes the health and dental history. Following a review of the data and radiographs and clinical examination, the dentist diagnoses the patient's condition and recommends two appointments of root planing and scaling. The patient nods his head in agreement and schedules an appointment with the dental hygienist. Answer Questions 1 to 3.

- Which of the following relationships exist?
 - A promise
 - An express contract
 - An implied contract
 - An implied warranty
 - An implied guarantee
- On return for the recommended root planing and scaling, the dental hygienist informs the patient that she will be administering anesthesia as part of the procedure. The patient becomes upset and declines the anesthesia. Which of the following should be done?
 - Treat the patient by root planing and scaling
 - Obtain an informed refusal for the anesthesia
 - Confirm that informed consent was obtained for the root planing and scaling by the dentist and obtain an informed refusal for the anesthesia
 - Obtain informed consent for scaling and root planing
 - Reappoint the patient
- The patient tells the dental care provider that she read about a new mouthrinse, developed by a local practitioner that dissolves calculus. The dental provider indicates to the patient that she would not use the mouthrinse if the dental association did not approve of it. Which of the following contractual responsibilities is the provider fulfilling?
 - Exercise reasonable skill, care, and judgment in the assessment, diagnosis, and treatment of patients
 - Have a proper license and registration and comply with all laws and practice within the scope of practice dictated by law
 - Use standard drugs, materials, and techniques; refrain from experimental procedures
 - Complete procedures within a reasonable time
 - Keep the patient informed of progress
- A dental assistant (legal in the state) is applying dental sealants to the posterior teeth of a 12-year-old child. The sealants were treatment planned a few months ago. The sealants treatment planned were for teeth 3, 14, 19, and 30. Informed consent was obtained for applying sealants on those teeth. Since the teeth were treatment planned, numbers 18 and 31 have completely erupted. The child is cooperative. The dental assistant decides to apply sealants to numbers 18 and 31. Which of the following might the dental assistant be accused of?
 - Invasion of privacy
 - Assault
 - Technical assault
 - Battery
 - Technical battery

5. A dental provider is accused of negligence by a dental patient. Which of the following does the patient need to prove?
 - a. The dental provider intended to harm the patient.
 - b. The dental provider had a legally recognized duty or responsibility that the provider missed.
 - c. The harm that occurred is directly related to what the dental provider failed to do.
 - d. a, b, and c
 - e. b and c only
6. A state dental hygiene association seeks to change the dental practice act to allow a collaborative practice model for the state. The association determines that the governor needs to sign the law to make the change. Which of the following is the best approach to make the change occur?
 - a. Ask the dental association to work to change the law.
 - b. Petition the state board of dentistry to change the law.
 - c. Hire a lobbyist to talk with a state legislator to get the law changed.
 - d. Find a supporter or supporters in the state senate or assembly to sponsor the bill and offer to provide expert testimony.
 - e. Petition the governor to change the law.
7. A federal law that protects employees from discrimination in hiring and firing based on pregnancy, childbirth, or related conditions is the:
 - a. Americans with Disabilities Act.
 - b. Pregnancy Discrimination Act.
 - c. Title VII of the Civil Rights Act of 1964.
 - d. Family Medical Leave Act.
 - e. Rehabilitation Act of 1973.
8. Prior to beginning two quadrants of root planing and scaling, the dental hygienist wants to obtain informed consent (legal for dental hygienists in the state). The dental hygienist describes the periodontal status of the patient and then discusses other important information. Prior to outlining the possible outcomes of the procedure, the dental hygienist describes the benefits and anticipated outcomes of the treatment. The dental hygienist describes the possibility of infection, sensitivity, trauma, bleeding, shrinkage in gingiva, and redness. The dental hygienist also describes how the procedure may not succeed in stopping the progression of the disease that could lead to tooth loss. The dental hygienist then proceeds to explain the risks and benefits of administering local anesthesia during the procedure. The dental hygienist then proceeds to begin the treatment. Which of the following elements of informed consent were missing in the scenario?
 - a. Alternative treatments to root planing and scaling and the risks and benefits to the alternatives
 - b. The cost of the treatment
 - c. The patient's obligation to cooperate in care
 - d. An opportunity for the patient to ask and have questions answered
 - e. a and d

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1. American Dental Education Association. Competencies for entry into the profession of dental hygiene. Exhibit 7. *J Dent Educ* 2004;68(7):745–749.
2. National Practitioner Data Bank and Healthcare Protection and Integrity Bank. Available at: <http://www.npdb-hipdb.hrsa.gov> Accessed September 2009



NATIONAL BOARD SUCCESS

MODULE

6

Objectives

After studying this chapter, and completing the study questions and activities, the learner will be able to:

- Implement study skills helpful in preparation for the NBDHE.
- Identify test-taking strategies useful for the Community Dental Hygiene portion of the NBDHE.
- Identify and implement personal preparation skills for the NBDHE.
- Identify physical, behavioral, and emotional signs of stress and test anxiety.
- Determine and implement effective strategies of managing stress and/or test anxiety during the preparation and testing process for the NBDHE



KEY TERMS

Test anxiety

Testlet

See Appendix 3 for the ADEA competencies addressed in this chapter.¹

Introduction

Preparation and success in the National Board Dental Hygiene Examination (NBDHE) will be enhanced through understanding and implementation of personal preparation, study skills, test-taking strategies, and simple stress reduction activities. Candidates must possess knowledge of dental hygiene concepts, develop the skills necessary to identify the key issues factored into each examination question, and the ability to respond appropriately.

THE NATIONAL BOARD DENTAL HYGIENE EXAMINATION

The NBDHE is administered by the Joint Commission on National Dental Examinations. The purpose of the examination is to assist state dental boards in determining qualifications of applicants who seek licensure to practice dental hygiene. The examination is intended to assess

the ability of the candidate to understand and apply information from basic biomedical, dental, and dental hygiene sciences in multiple-choice and problem-solving formats. Note: individual states determine the specific requirements for licensure and the NBDHE is intended to fulfill all or some portion of the written examination requirement. Limitations on acceptance of NBDHE results vary from state to state and should be reviewed with the candidate's state(s) of interest.

The NBDHE is composed of approximately 350 multiple-choice questions. The examination is delivered in two sessions. The morning session (component A) is 3 hours and 30 minutes in length, consisting of 200 discipline-based, stand-alone test items addressing the scientific basis for dental hygiene practice, provision of clinical dental hygiene services and community health/research principles. The afternoon session (component B) is 4 hours in length and comprises 150 questions based on dental hygiene case scenarios.

Component A includes the Community Health/Research Principles portion of the examination, with 24 questions, which are distributed within the following categories (based on information from the 2009 NBDHE Guide):

1. Promoting health and preventing disease within groups (including media and communication resources) (21%)
2. Participating in community programs (46%)
 - Assessing populations and defining objectives
 - Designing, implementing, and evaluating programs
3. Analyzing scientific literature, understanding statistical concepts, and applying research results (33%)

Note: The distribution of questions may change at the discretion of the NBDHE Joint Commission. It is recommended that candidates visit the American Dental Association (ADA) web site for the most current guidelines.

The Community Dental Hygiene section test format is presented as testlets. A **testlet** is a short, one to two paragraph descriptive scenario of a problem or case study followed by five situation-related multiple-choice questions for which there is only one correct or “best choice” answer. The testlet is reserved for the Community Dental Hygiene section, which differs from traditional stand-alone, fact, or case-based questions. The testlet format requires critical-thinking skills to utilize foundational knowledge in the analysis and application of problem-solving skills rather than rote memorization.

EXAMINATION PREPARATION

There are many resources available to help the candidate prepare for the NBDHE. In addition to reviewing course materials and review texts, the candidate will find it beneficial to incorporate personal preparation strategies to aid in their success.

General Preparation

1. Allow plenty of time for review. Nothing boosts confidence like advanced preparation.

It is prudent to begin the review process at least 4 months prior to the examination. Schedule small blocks of uninterrupted time for review. In this way, it will be possible to complete a structured sequence of review without excessive pressure. Depending on your learning style, joining a study group of three to five peers may be helpful. It is best to collaborate with individuals who have the same study habits and educational self-discipline.

2. Become familiar with the examination format by obtaining a recent release of the NBDHE. Many dental hygiene schools have these examinations on file or you may obtain a copy for a fee from the Commission at National Board of Dental Hygiene Pilot Examination, 211 East Chicago Avenue, Suite 600, Chicago, IL 60611. Use this examination to test yourself on a day without potential interruptions. It is recommended to attempt to mimic the testing circumstances according to time of day and the “test center procedures” as outlined in the most recent NBDHE Candidate Guide. Based on the results of this test examination, identify your areas of strength and weakness. Use this information to plan and organize your sequence of review in the coming months. Devise a review schedule to include all areas you marked incorrectly on the examination, as well as the areas of the examination that were questionable in your review plan (even if you guessed correctly).
3. It is advisable to obtain a review text to aid in your study. Many comprehensive dental hygiene review texts are available. Additionally, textbooks and course information used in your program of study should be reviewed. Although the Commission states that National Board test items are not based on specific textbooks, it has published a list of reference texts used by the test construction committee. Those texts having significance in Community Dental Hygiene are listed in Box 18-1. The most current list is available online with the Commission.
4. Plan study time. Schedule approximately 2–4 hours per week to prepare for the



BOX 18-1 Reference Textbooks Used for NBDHE

The ADA test construction committees have used the latest editions of the following textbooks as references for the Community Dental Hygiene testlets:

Mason JM. *Concepts in Dental Public Health*. Baltimore, MD: Lippincott, Williams & Wilkins.

Burt BA, Eklund SA. *Dentistry, Dental Practice, and the Community*. Philadelphia, PA: W.B. Saunders.

Geurink K. *Community Oral Health Practice for the Dental Hygienist*. Philadelphia, PA: W.B. Saunders.

Thomson EM, Bauman DB, Shuman D, Andrews EK. *Case Studies in Dental Hygiene*. Pearson Prentice Hall.

Little JW, Falace DA, Miller CS, Rhodus NL. *Dental Management of the Medically Compromised Patient*. Mosby.

examination. Designate a specific day and time to devote to this preparation. Study the most difficult material when you are most alert. Without a plan, best intentions are often put aside to focus on the immediate task or school assignment. If you find your plan is not working, reassess and reorganize to allow adequate time for preparation.

5. Read and understand the format and design of the examination. A printable version of the Candidate's Guide for the NBDHE is available online.
6. Many comprehensive Board Review courses are available and marketed directly to dental hygiene programs. Information may be available through your school or program director. If you plan to attend a Board Review course, thoroughly investigate the content and reputation of the course. Review courses can be expensive and require travel, but can also reduce anxiety about the examination.

Study Skills and Learning Styles

Learners incorporate different strategies, approaches and capabilities for studying/learning. It is important for an individual to identify their learning style to maximize study time and an effective strategy for review. Learning styles are traits that reflect how an individual approaches

learning new material or tasks. Various recognized self-scoring inventories include the Kolb Learning Style Inventory² and the Myers–Briggs Type Indicator.³ Various learning styles include reflective or active, sensing or intuitive, visual or verbal, and global or sequential. Most individuals are a combination of the various learning styles, with a preference for one style over another.

There are many opportunities to discover your preferred learning style. A college testing center can help, many books are written on the subject, and several web sites are available to obtain a free inventory. North Carolina University⁴ offers an index of learning styles questionnaire that is automatically scored to aid individuals who wish to determine their own learning style preference. Knowing your preferred learning style can help you plan a more efficient and effective method of study. Table 18-1 provides a brief overview of learning styles and suggestions about how to maximize study strategies based on learning preferences.

Test-Taking Strategies

It is advantageous to employ general test-taking strategies during the examination. These strategies will help the candidate think critically, focus on relevant details, and eliminate any distract-

TABLE 18-1 LEARNING STYLES AND STUDY STRATEGIES

LEARNING STYLE	CHARACTERISTICS	TO MAXIMIZE STUDY STRATEGY
Sensing	• Likes learning facts and solving problems • Detail oriented • Practical • Likes connections to real world • Dislikes complications and/or surprises	• Identify specific examples of concepts • Relate information to real world situations
Intuitive	• Innovative • Likes discovering possibilities • Tends to work faster • Dislikes memorization and routine calculations	• Find theoretic connections and apply to facts • Slow down to avoid mistakes due to lack of attention to detail
Visual	• Tends to remember what they see • Likes pictures, charts, and diagrams • Dislikes strictly reading text	• Create concept maps to represent visual connections • Find pictures, charts, and diagrams to aid memory of information
Verbal	• Tends to remember words (written and spoken)	• Write outlines or rewrite information in your own words • Working in groups may be helpful as you hear others verbalize information
Sequential	• Tends to understand in linear steps • Follows a logical path in problem solving • Dislikes skipping steps or jumping from topic to topic	• Outline material in a logical order • Study in the order of the textbook, handouts, or as the information was presented in class • Create inventories
Global	• Tends to gather information somewhat randomly, often without initially identifying the connections. • Frequently experiences the “Ah ha” moment of suddenly understanding a concept.	• Identify the “big picture” of a topic before trying to master the details • Review the objectives and skim the entire chapter to get an overview prior to focusing on details • Try to relate the topic to things already known • Rather than planning to study several topics in an evening, try to set aside larger blocks of study time for individual subjects
Active	• Tends to retain and understand information best by doing something active. This may include explaining or discussing material with others.	• Study in a group to facilitate an active relay of information on the topic • Create games or role plays to review information • Brainstorm with a peer • Participate in active discussion
Reflective	• Tends to think about information • Often prefers to work alone	• Pause while studying new material to review the reading • Pause to think of possible applications or questions about the information presented • Write a simple summary of the information to help retain the material

From Felder R, Soloman B. Learning styles and strategies. Available at: <http://www.ncsu.edu/felder-public/ILSdir/styles.htm>. Accessed July 2009.⁴

ers within the testlet, case, or multiple-choice questions.

1. Approach the examination with confidence and a positive attitude. View the examination as an opportunity to show how much you have learned.
2. Breathe. Deep “belly” breaths help to release endorphins and stimulate the thinking portions of your brain.
3. Be comfortable but alert. Change positions periodically to help you relax. However, it is important to maintain an upright posture in your seat to avoid unwanted fatigue.
4. Listen and read all instructions carefully.
5. Budget your time reserving approximately 10% of your test time for review of questions left blank.
6. Read the stem of the question completely and carefully to determine what the question is asking.
7. Try to formulate an answer before looking at the options presented. Look for the option that most closely represents your answer.
8. When unable to choose an answer immediately, eliminate all obviously incorrect answers to narrow the choices.
9. Read all answers carefully to determine if the response to the question is complete and appropriate. Look for the best answer that generally applies in most situations to conditions presented in the question.
10. Skip a question if you “go blank.” Then, consciously relax, take a deep breath and move on. Remember to return to unanswered questions later.
11. Errors are made by overlooking key words. If a question does not make sense, read the question carefully and identify these key words to aid in formulating the answer.
 - Absolutes are seldom appropriate for health conditions and are usually incor-

rect answers. Example: Answers that contain the words: always, never, any, all, or every.

- Be alert for the words except, not, and least in the question.
 - Be alert for grammatical clues. If a question indicates a plural response, all options in singular format may be an indication of an incorrect answer.
 - Avoid selecting an answer that contains a word or answer you have never seen before. There is a high probability that if you have never seen the answer before, it is a distracter.
12. Some answers are revealed within the examination itself. Sometimes clues or answers may be found in other questions. As you read the questions, jot down brief notes, indicating ideas you may use later in your answers.
 13. Do not change answers unless you are confident of the correction. Remember, your first answer is usually correct.
 14. Resist the urge to leave as soon as all the items are completed. Don’t panic when other candidates begin to leave. There is no advantage to being the first to complete the examination.
 15. Make sure you have answered all questions; do not leave blanks. Make an educated guess if the correct answer is still in doubt after the choices have been narrowed as much as possible. Remember, there is no penalty for guessing.

Personal and Physical Preparation

To prevent test anxiety, it is recommended to take care of personal and physical needs prior to the examination. The guidelines in Box 18-2 will help ensure that the candidate arrives at the test site calm and ready to tackle the examination.



BOX 18-2 Guidelines for Personal Preparation

The week before:

- Review the examination procedure posted from the ADA testing services.
- Avoid cramming; maintain your regular study schedule; review the most difficult areas.
- Plan your route to the examination site and determine travel time. Be generous in your estimate of travel time. It is recommended to make a dry run at the same time of day you will actually be in traffic on exam day. Identify parking available at the facility.
- Exercise; however, this is not the time to begin a rigorous new exercise program.
- Eat healthy foods, drink lots of water, and avoid alcohol and caffeine.
- Get plenty of rest.
- Do not panic; panic decreases effectiveness. Assume there will be questions on unfamiliar content.
- Think positive. Relax. Envision yourself passing the examination. Taking the test with the attitude that one is prepared and capable of success is imperative.

The night before:

- Plan a fun, relaxing evening. Avoid studying the night before the examination.
- Eat healthy.
- Get a good night's sleep. (Do NOT take a sleep aid if you are unfamiliar with the effects it may have on you.)
- Avoid alcohol.
- Avoid talking to other students about the examination. Anxiety is contagious!
- Set out all needed material (e.g., several sharpened pencils and erasers, watch, admission card, picture identification, and magnifying glass).
- Lay out clothing for the morning. Dress for comfort. Layer clothing in case the room temperature is too hot or cold.
- Set your alarm; give yourself plenty of time to get ready and travel.
- Think positive. Envision yourself passing the examination.

That morning:

- Give yourself plenty of time.
- Eat a healthy breakfast before the examination: protein for endurance and carbohydrates that easily convert to energy on demand. Avoid caffeine and sugar as these often have a letdown effect.
- Arrive early; allow plenty of time for traffic, parking, and bad weather.
- Come prepared. Bring all needed materials (e.g., several pencils, erasers, watch, admission card, identification, magnifying glass, lunch). Leave all study materials at home. Note: mechanical pencils, eating, and drinking are not permitted in the testing room.
- Stay calm. A little anxiety is normal. Take regular deep breaths. Maintain a positive attitude and reaffirm that you will pass.

PHYSIOLOGY OF TEST TAKING, STRESS AND TEST ANXIETY

Most candidates feel somewhat anxious before beginning the NBDHE. The most common misconception about stress or anxiety is that it is bad and must be avoided. Stress is a common human phenomenon. Some nervous anticipation can actually help you perform at an optimal level. Stress or anxiety becomes a problem when it interferes with the candidate's ability to concentrate, think logically, or recall facts. Candidates who can recognize personal physical, behavioral, and emotional symptoms of stress and develop appropriate coping skills may also improve performance on the NBDHE.

Test anxiety is a type of performance anxiety; a feeling often experienced when performance really counts, when the pressure to do well has escalated to an unmanageable level. The body prepares for whatever is created in the mind. Stress can intensify by what you say to yourself (self-talk) about the circumstance, the environment, or what appears to be happening. The key to a successful performance is to identify your optimal level of stress and how to reduce excess stress when it occurs.

Test anxiety is more common than most people realize and is likely to be experienced by those individuals who worry a lot or who are perfectionists. The physical responses to stress are biological and may include hormonal, chemical, and/or muscular changes in the body. The biological state of fear or anxiety is a response to a perceived threat, the so-called "fight or flight" response. Physical symptoms may include tension headaches, clammy hands, sweating, depression, indigestion, nausea, irritability, anger, insomnia or hypersomnia, elevated blood pressure, exhaustion, twitches, muscle tension, shortness of breath, chest tightness, rapid heartbeat and feeling faint, bored, dissatisfied, frustrated, tense, inadequate, worried, helpless, or overwhelmed. If the stress becomes too great, the individual's brain will shut down, go blank, or experience a temporary mental block. In effect, test anxiety can interrupt fundamental thinking

processes such as remembering, analyzing, and problem solving.

Many people with test anxiety are individuals who frequently put a great deal of pressure on themselves to perform well, have unrealistic expectations, or a behavior pattern of procrastination. A single experience of test anxiety is enough to leave an individual wondering if it will happen again. As a result, they often avoid studying which leads to last minute cramming, which can generate feelings of inadequacy and create a situation in which the information becomes disorganized in the individual's mind.

Feelings of Stress

Identifying feelings of stress/anxiety and knowing how to combat negative stress reactions is an important step in improving performance. Practicing stress reduction exercises will help the candidate respond appropriately when feeling challenged.

Answer the following questions to identify the positive and negative feelings experienced during typical testing situations:

1. How do you feel when you are stressed? What are the physical symptoms?
2. How do you feel when you are focused? What are the physical symptoms?
3. How do you feel when you lose your focus? What are the physical symptoms?
4. How do you feel when you are confident? What are the physical symptoms?

To reduce the feelings of stress and improve performance it is important to stop negative self-talk and implement positive self-direction by implementing one or more of the following strategies:

- a. Breathe several deep "belly" breaths.
- b. Stay focused on what you want by listening to a positive inner voice ("I can manage this," "I'm in control of myself," and "This is just another day").
- c. Stay calm: ground yourself and sense your surroundings (stop fidgeting, feel the chair beneath you, plant your feet firmly on the ground).

- d. Stay confident by envisioning small manageable steps (one question at a time).
- e. Prepare relentlessly.
- f. Share your feelings and goals (make it real by telling others you are going to pass this examination).

TIPS TO HELP DEAL WITH STRESS

- Keep physically healthy with regular physical activity (jogging, walking, sports, etc.)
- Eat healthy and avoid skipping meals. Lean protein, complex carbohydrates, and good quality fats in the morning will help the thinking process
- Avoid the idea of being perfect
- Learn how to relax
- Avoid alcohol, drugs, or any mind altering substance
- Maintain a positive attitude and avoid negative thoughts
- Talk about your stress with friends and family who are supportive
- Make time for fun

DEALING WITH TEST ANXIETY

1. Breathe
 - Inhale deeply (from your belly) for the count of 4, hold for a count of 2, exhale for a count of 6 to 8 and rest for a count of 2. Repeat several times. This type of breathing has been proven to increase alertness, clarify thinking, reduce anxiety, regulate appetite, improve sleep, lower pain, relax and calm an individual. Remember: if you can breath, you can think!
2. Relax
 - Relaxing helps to allow an individual to think, whereas fidgeting acts as a distracter to thinking. It is worthwhile to practice methods of relaxing prior to taking the examination.
 - Activity 1: Relax your muscles. This can be done by systematically tensing and then relaxing different groups of muscles in your body. Tense for 10 seconds then relax for 15 to 20 seconds.

- Activity 2: Get in touch with your body rhythms. Place one hand on your heart, feel the heartbeat. With the other hand tap along with the beat, the longer you tap, the more you will find your body relaxing. This activity will allow you to relax your mind and body in the same way as meditation works to relax an individual.

3. Attitude and Mental Preparation

- The body will prepare for whatever is created in an individual's thought process. When an individual believes or tells oneself that everything is manageable, the brain is able to think rather than shift into survival mode. In essence, what you think about, you will bring about! Self-talk of "I can't do this," "I'm not good enough," or "I'm going to fail" will only serve to increase anxiety. Alternatively, phrases such as "No problem" or "I am going to succeed" will reduce anxiety and help restore the thinking portion of your brain. Practice envisioning yourself opening the notification of passing the exam. Remember to focus on an internal dialogue that will reduce stress level rather than increase it.

4. "Ground or Plant" Yourself

- Avoid fidgeting. Plant feet firmly on the ground for stability and feel the chair beneath your body providing stability. Take a moment to listen to the sounds in the room, smell the lead of the pencil, and see the colors within the room. A keen awareness of your stability and surroundings will help to avert the escalating feelings of anxiousness and bring you back to a sense of calm.

5. Studying at the Professional/College Level

- Studying at this level is not just reading the textbook or notes over and over. Professionals are expected to know and understand concepts, theory, relationships, and application. "Real" studying involves critically thinking, analyzing, writing things down, and organizing the information in a meaningful way. The more you know the material, the more confident you will

feel. When you feel confident and expect to do well, you will be able to relax into the examination after the initial jitters/apprehension passes.

CONSIDERATIONS FOR DIVERSE LEARNERS

Candidates With Disabilities

Special arrangements may be granted to candidates with a qualifying disability to be examined. To be considered for special arrangements, the candidate must submit a written request well in advance of the testing date. Refer to the guidelines outlined under the NBDHE Testing Services available from the ADA for qualifying disabilities and application deadlines.

Candidates With English as a Second Language (ESL)

The Joint Commission states that translators will not be allowed in the testing area. Applicants with ESL may encounter unique problems when studying for the NBDHE. ESL candidates may enhance their learning and test-taking skills by employing one or more of the following strategies:

- Reading and then writing the information when reviewing.
- Monitoring comprehension by summarizing information.
- Seeking visual aids to support verbal explanations.
- Working in groups to promote the sharing of information.

Effort has been made by the NBDHE test construction committee to assure that test items have been written in such a manner as to examine a candidate's knowledge rather than their command of the English language. Extraneous information has been removed. Avoid the tendency to approach the examination with the idea that the examination is trying to "trick" you. All information presented is pertinent to the question/case and may be used to help formulate your answer.

EXAMINING A TESTLET

The questions in the NBDHE have been written with specific intent and, as much as possible, extraneous information has been eliminated. Only one option is clearly the best answer for each question. Other possible options are designed to distract the attention of a candidate who lacks sufficient knowledge of the material; therefore, it is imperative the candidate understands the information the question was designed to seek.

The following scenario is an example of a testlet. To demonstrate test-taking strategies, key factors in the scenario have been identified.

EXAMPLE TESTLET:

You are employed by a local health department. The department just received a small federal grant to provide smoking cessation services to a local middle school. Your job is to ascertain tobacco use and manage the development of the project. You create a student questionnaire to determine the current level of smoking behavior and the awareness of the dangers of smoking. After the program, you will reassess the population with the same questionnaire to determine if the program had an effect on the population.

Key identifiers for this question include (i) the population: middle school students, (ii) the types of assessment needed: tobacco use and dangers of smoking, and (iii) how the assessments will be gathered: the questionnaire.

1. Which of the following smoking-related issues would MOST appeal to this population?
 - a. Halitosis
 - b. Tooth loss
 - c. Heart disease
 - d. Emphysema
 - e. Low-birth-weight babies

Answer: a. Halitosis is a smoking-related issue that would appeal the most to the middle school population. The other issues would be of relatively low interest as they occur much later in life and would not be perceived as imminent problems.

2. Any combination of preventive, educational, organizational, economic, and environmental supports for behavior conducive to health describes:
- health education.
 - dental public health.
 - health promotion.
 - educational theory.
 - community assessment.

Answer: c. Health promotion. Health promotion is the science and art of helping change the lifestyle of individuals and society to attain optimal health, which places an emphasis on improving quantity and quality of life for all and enables people to improve their health, including the use of any preventive, educational, or administrative policy, program, or law. Health education is related to educational or learning activities designed to increase knowledge. Dental public health is more global in nature to aspects preventing and controlling dental diseases and promoting dental health through organized community efforts.

3. Students who participate in a single presentation of the dangers of smoking will not change their use of cigarettes. This statement is an example of a (an):
- instruction.
 - observation.
 - objective.
 - hypothesis.
 - null hypothesis.

Answer: e. A null hypothesis states no difference will be found, whereas a hypothesis is the statement of expected outcomes of a study.

4. All of the following areas need to be examined when performing a needs assessment EXCEPT:
- demographics.
 - behavioral characteristics.
 - hereditary characteristics.
 - health status.
 - availability of providers.

Answer: c. Hereditary characteristics are helpful in assessments involving an individual but are not

significant in determining the oral health needs of a community or population.

ADDITIONAL SAMPLE TESTLETS

Testlet #1

A dental hygienist has recently taken a position with the Indian Health Service. His responsibility is oral health promotion for the Native American community. The community water system is not fluoridated. Data from the Surgeon General's Report suggest a usage of spit tobacco as high as 40% in junior high and high school children within the Native American population. To develop appropriate health promotion strategies, the dental hygienist wants to determine the oral health status and cumulative dental experience of the teachers and students in the local school.

1. What are the BEST indices to evaluate the oral health status of the teachers in the school?
- OHI-S, dmfs
 - PII, TSIF
 - PDI, CPI
 - GI, DMFT
 - CPI, DMFS

Answer: e. Teachers, as adults, would best be assessed by the CPI and DMFS (permanent teeth).

2. Based on the Surgeon General's Report, which of the following would be appropriate topics to discuss with the elementary school classes and teachers?
- Oral hygiene instructions
 - Careers in the dental field
 - How to respond to peer pressure regarding risky behaviors
 - Risks of tobacco product use
 - C and D

Answer: e. Students need education about the risks of tobacco use and the skills to counter peer pressure.

3. Which of the following would be the MOST cost-effective method to increase fluoride exposure in this community?
 - a. Encourage parents to purchase toothpaste products with fluoride.
 - b. Encourage local physicians to write prescriptions for fluoride supplements.
 - c. Implement a program for annual professional fluoride treatments for all appropriately aged schoolchildren.
 - d. Implement a fluoride tablet program in the school for appropriately aged children.
 - e. Work with the city council and local leaders to implement community water fluoridation.

Answer: e. Community water fluoridation is the most cost-effective and socially equitable way to deliver fluoride to a community.

4. The dental hygienist wishes to assess the oral health status of the students. Because of time constraints, he samples grades K, 3, and 6 to determine student oral health status. Which oral health indices would be the BEST to use?
 - a. GI, PI
 - b. DMFS, dfs
 - c. OHI-S, dmf
 - d. TSIF, CPI
 - e. CPI, DMFS

Answer: b. For children with a mixed dentition, both DMFS and/or dfs may need to be used. Other indices evaluating plaque, fluorosis, or periodontal disease would not provide useful information for this age-group.

5. There have been 18 new cases of squamous cell carcinoma this year in the elder population of this community. This is an example of:
 - a. rate.
 - b. incidence.
 - c. prevalence.
 - d. proportion.
 - e. average.

Answer: b. Incidence is the number of new cases of a disease in a population per unit of time.

Testlet #2

Residents in a low socioeconomic West Coast rural community have an average annual income of \$15,000. Public facilities include two local medical clinics, a skilled nursing facility, home health services, and dental clinics. The nearest medical center is more than 30 miles north. There are three elementary schools, one middle school, and one high school. A local community college is in the neighboring city, 15 miles west of the community.

There is no fluoride in the public water supply. Several legislative attempts have been made to institute water fluoridation, but none have passed. The local elementary schools participate in a weekly fluoride mouth rinse program. Local dentists and pediatricians typically prescribe fluoride supplements; however, compliance is low. A study to determine the caries status of children is being planned. The age-groups to be studied are listed in the following table:

AGE OF STUDENTS IN STUDY

AGE	NUMBER
6–8	273
9–11	228
12–14	217
15–18	198

1. Which sampling method would best accomplish the task of determining caries status?
 - a. Random
 - b. Stratified
 - c. Validated
 - d. Convenience
 - e. Systemic

Answer: b. Stratified: randomly selects a specific number of residents from each age-group listed, allowing a representative sample of the actual population to be included. Random would not guarantee proportional representation of each age-group. A convenience sample would be the least representative of the age-groups.

2. Which epidemiologic index would be the BEST choice for evaluating caries prevalence of this population?
- GI
 - CPI
 - RCI
 - PDI
 - DMFS

Answer: e. DMFS. RCI is a root caries index (most often seen in the elderly), CPI and PDI assess periodontal needs, and GI assesses the gingival condition.

3. What is the recommended dosage of supplemental fluoride for a 6-year-old at risk of caries in this community?
- 1.5 mg/day
 - 1.0 mg/day
 - 0.5 mg/day
 - 0.25 mg/day
 - No supplemental fluoride is needed.

Answer: b. 1.0 mg is the recommended dosage of supplemental fluoride for a 6-year-old in a nonfluoridated community.

4. If a sealant program is implemented in the elementary school, measuring sealant retention rates of the program is an example of what kind of evaluation?
- Process
 - Formative
 - Cursory
 - Outcome
 - Longitudinal

Answer: d. Outcome is an assessment of the end point success of a program.

5. Which one of the following has the MOST influence on the rate of dental utilization?
- Socioeconomic status
 - Ethnicity
 - Race
 - Gender
 - Geographic location

Answer: a. Although all are factors, socioeconomic status is the MOST important influence on the rate of dental utilization.

Testlet #3

A home for adolescents awaiting prosecution houses 22 males and 18 females. The typical stay for the adolescents ranges from 2 to 6 months. The age of the residents ranges between 14 and 17 years. Fewer than 2% of the sheltered teens attend traditional high school. A training project with GED education opportunities has recently been implemented for the teens. The project will provide participants with assistance in reading and writing skills, resume and interview preparation, personal hygiene, appropriate attire, and working skills. Dental hygiene students from a nearby dental hygiene program have volunteered to assess the oral health needs using the OHI-S, provide preventive dental procedures and appropriate restorative referrals for the teens participating in the project.

1. The OHI-S is used to measure all of the following EXCEPT:
- stain.
 - plaque.
 - calculus.
 - material alba.
 - demineralization.

Answer: e. The OHI-S is used to measure debris (plaque, material alba, stain, and food) and calculus on specific tooth surfaces, not tooth demineralization.

2. Every third teen listed by birth date on the rosters of teen participants will also be selected for assessment of decayed, missing, and filled teeth. This sampling method is known as:
- random.
 - stratified.
 - systematic.
 - convenience.

Answer: c. Systematic samplings are established by selecting the “nth” person on a roster of individuals. A random sample would allow each resident an equal opportunity to be selected but would not guarantee proportional representation by age. A stratified sample allows a proportional representation from each group but

would not allow each member within a group an equal chance of selection. A convenience sample involves selecting a sample that is not necessarily representative of the total population being studied.

3. After watching a video on toothbrushing technique, the residents will be able to demonstrate the Modified Bass toothbrushing technique on a typodont to a peer. The “condition element” of this objective is:
 - a. after watching a video.
 - b. the Modified Bass toothbrushing technique.
 - c. the residents.
 - d. will be able to demonstrate.
 - e. on a typodont.

Answer: a. The “condition element” of an instructional objective restricts or guides the participants as they attempt to meet the objective. The “audience element” would be the teen residents, the “behavior element” would be they will be able to demonstrate, and the “degree element” of the objective is the Modified Bass toothbrushing technique. The phrase “on a typodont” serves to qualify the degree element.

4. Approximately 20% of project participants completed their GED education, 75% completed preventative dental hygiene care and 38% completed restorative care by the time they were either transferred or dismissed from the house. This is an example of project:
 - a. expectations.
 - b. evaluation.
 - c. implementation.
 - d. assessment.
 - e. supervision.

Answer: b. Project “evaluation” is a judgment or finding of the worth of a project. Assessments are the tools used to determine the needs of the population; implementation is the steps utilized in putting the program into action; supervision is the administration or overseeing of a project; and expectation denotes a preplanned result and is not typically a term used in public health or research projects.

Testlet #4

You are the dental hygienist for a nursing home community of 150 residents. One of the administrator’s goals is to improve the oral health status of the residents. She asks you to develop a program to achieve this goal.

1. You surveyed the nurses by written questionnaire concerning their understanding of dental health and oral hygiene procedures. Following compilation and evaluation of the answers, you planned the in-service program for the nurses. These activities parallel which of the following private practice activities?
 - a. Assessment and diagnosis
 - b. Diagnosis and treatment planning
 - c. Assessment, diagnosis, and treatment planning
 - d. Assessment, diagnosis, and treatment
 - e. Assessment, treatment planning, implementation, and evaluation

Answer: c. These activities most closely parallel assessment, diagnosis, and treatment planning. There were no implementation, treatment, or evaluation parallel activities up to this point in the program.

2. You must prioritize the oral health issues in the nursing home. Which of the following is NOT a criterion for determining whether a particular condition constitutes a public health problem?
 - a. The public believes it is a problem
 - b. A condition that is a cause of morbidity
 - c. A condition that is a cause of mortality
 - d. A condition that is widespread
 - e. The disease is curable

Answer: e. Whether or not the disease is curable does not determine whether or not the disease is considered a public health problem.

3. Root Caries Index scores for a sample of this population were 2%, 3%, 3%, 4%, 4%, 5%, 5%, 5%, 6%, and 7%. Which of the following indicates the mode for this sample?
 - a. 3%
 - b. 4%
 - c. 5%

- d. 6%
- e. 7%

Answer: c. The mode is the number that occurs most frequently in a population.

4. Which is the MOST effective way to provide oral hygiene instruction to the residents?
- a. Individualized instruction
 - b. Lecture and demonstration
 - c. Videotaped presentation
 - d. Pamphlets
 - e. General instructions posted in all the resident bathrooms

Answer: a. Individualized instruction is the most effective educational approach (although not efficient for large groups). Lecture and demonstration is the most efficient way to provide oral hygiene instruction to large groups of people, but it is not as effective as individual instruction. Pamphlets are best as take-home tools after formal instruction.

5. The BEST measure of the effect of the program you develop for this group is:
- a. total cost.
 - b. change in attitude.
 - c. health improvement.
 - d. resident happiness with the program.
 - e. staff happiness with the program.

Answer: c. Health improvement is the BEST measure of the effect of an oral health program. Cost measures, efficiency, attitude changes, and happiness may not result in oral health status change, which was the objective of the program.

Testlet #5

You have been contracted by a state health department to assess the oral health needs of the Head Start population in the county. To assess the needs of this population, you provided oral screenings to all Head Start participants for 3 months. The siblings of the applicants were also screened. To aid in the effort, you hired two examiners. Prior to performing the screenings, the two examiners compared their techniques and diagnostic similarities using the chosen indices.

1. The type of sample used is a:
- a. random sample.
 - b. stratified sample.
 - c. judgment sample.
 - d. convenience sample.
 - e. quota sample.

Answer: d. A convenience sample is the simplest method, involving selecting a convenient group of participants.

2. The process of comparing techniques and diagnostic similarities among examiners is called:
- a. calibration.
 - b. comparison.
 - c. specificity.
 - d. reliability.
 - e. validity.

Answer: a. Calibration

3. The screenings revealed that 89 of 200 children had carious lesions. This is an example of:
- a. incidence.
 - b. prevalence.
 - c. a percentage.
 - d. a range.
 - e. a mean.

Answer: b. Prevalence is the number of cases in a population at a given time.

4. The two examiners agreed in their diagnostic decisions 83% of the time. This is called:
- a. validation.
 - b. inter-rater reliability.
 - c. consistency.
 - d. intra-rater reliability.
 - e. inconsistency.

Answer: b. Inter-rater reliability is the amount of agreement between two or more examiners.

5. If you found that 32% of the children had dental sealants, where would you look to determine whether that percentage was exceptional, at the national average, or low and needed to be a priority?
- a. Dental public health competency objectives
 - b. American Clinical Guidelines Resource Guide

- c. Healthy People 2010 Objectives
- d. World Health Organization Survey Manual
- e. Local health department

Answer: c. The Healthy People 2010 Objectives lists the national baseline and the objectives for the nation.

Summary

Accredited dental hygiene programs provide a sound base of knowledge to prepare candidates for the NBDHE. Candidates preparing for the examination can enhance this foundation through a well-designed review process. Preparations should include knowledge of test-taking strategies, application of appropriate study techniques, stress reduction activities, and personal preparations. With a sound educational foundation, appropriate preparation, and a positive attitude, the dental hygiene candidate will achieve success in the NBDHE.

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Appendix 1

ANSWERS TO REVIEW QUESTIONS

CHAPTER 1

1. e.
2. d. The 1935 Social Security Act provided aid to states through Maternal and Child Health (MCH) grants, which included oral health services.
3. c. The trials began in Michigan and New York in 1945.
4. b. The armed forces experience led to the development of the National Institute of Dental Research (NIDR), which addresses national dental problems.
5. e. The core functions of public health are a, b, and c.

CHAPTER 2

1. d. This person is most likely to have some type of dental insurance benefit and should be able to find an oral health care provider. The others have significant barriers (e.g., geographic, age).
2. d. More than 51 million school hours are lost to dental illness each year.
3. e. The fifth action seeks broad-based coalitions, not just collaborations among oral health professionals.
4. d. *Less* restrictive practice acts may increase access to care, whereas more restrictive practice acts tend to limit access.
5. a. The other situations represent the opposite of current trends.
6. c. Several scientific groups are available (e.g., The Cochrane Group) that review studies and translate the research to practitioners.

CHAPTER 3

1. e. All are barriers to accessing oral health care.
2. c. Approximately 50 countries currently use dental therapists.
3. e. Working professionals are more likely to have dental insurance.

4. d. World Health Organization.
5. a. These all represent barriers in the structure of the system for oral health care.
6. e. All of these statements are true.

CHAPTER 4

1. e. The client is the community.
2. b. The American Dental Education Association.
3. d. The Department of Health and Human Services oversees the USPHS and the Commissioned Corps of the USPHS. (See Figure 1-2.)
4. e. A public health dental hygienist may be called upon to perform any or all of these roles professionally.

CHAPTER 5

1. b. All elements are required, other than crisis reaction. Careful planning should avoid the need to react to a crisis.
2. d. Although all elements are important, the most important consideration is to obtain community input.
3. c. A planner wants community input from the beginning of the needs assessment. Community involvement and input, however, are important throughout the planning process.
4. c. Determining the cost-effectiveness of a community program is part of program evaluation and the most similar to the evaluation of individual patient care.
5. e. All of these techniques can best use the available resources to plan effective programs.

CHAPTER 6

1. a. Although the need to publish a paper may be in the back of the planner's mind, it is not a reason for conducting a needs assessment. All other reasons given for conducting a needs assessment are valid considerations.
2. d. Repairing equipment is an indirect program activity. This activity is supportive in

nature and not directly involved in planning or intervention delivery.

3. a. Goals and objectives are considered the heart of the program plan; they guide the intervention and are the basis for the evaluation.
4. b. False. This describes a program goal. It is more specific than a mission statement because it identifies what should change to work toward broad improvement in the mission of the program. A mission statement only describes the program's reason for existence.
5. a. True. It is important to do an extensive search for existing data to support the need for a program before going to the time and expense of collecting primary data.
6. a. A mission statement is a broad statement of directional change.
7. c. A program objective guides program activities or interventions.
8. b. A program goal identifies a desired change that should occur.
9. d. A program intervention identifies a specific activity.

CHAPTER 7

1. c. It is important to raise awareness about the needs among interested parties before planning the program. This group should be involved throughout the planning, implementation, and evaluation process. It is important to have parent and school nurse participation, together with others in this group. It is too early in the process to determine whether children need to be rescreened. The adequacy of the state data will need to be determined.
2. e. All of the ways increase the capacity and effectiveness of programs. Coalitions or partnerships strengthen the effectiveness of programs. Grants supplement available funds. Combining or leveraging resources with other health programs that have similar goals is a wise use of limited dollars.
3. d. Community water fluoridation would be the most cost-efficient, effective, safe way to reduce decay rates. Interventions that require daily compliance (e.g., tooth brushing education) would predictably only show short-term

reductions in plaque levels and would not be as effective as interventions that do not. Treatment programs would reduce the unmet need but would not reduce caries rates.

4. b. Goals and objectives determine what a program intervention is designed to accomplish and form the basis for any evaluation.
5. e. All of these parties should be involved in the process.
6. c. It is important to determine the evaluation method during developmental stages.
7. b. A 1-year assessment of sound surfaces compared with decayed surfaces is a summative, or outcome, evaluation. It describes a desired health outcome. The other possible answers are all examples of formative, or process, evaluation.
8. b. It is best to target the areas with the highest need. Because teeth should be sealed shortly after eruption, many programs target children in first, second, fifth, and sixth grades. Sealants are indicated for teeth with deep pits and fissures.

CHAPTER 8

1. d. All of these are associated with disparities in health.
2. a. These three factors are the basis for a good model for health promotion.
3. c. All other factors listed can contribute to the overall empowerment of people to attain equity in health.
4. e. All stages require educating the public about the benefits of community water fluoridation.
5. b. Other responses include topical applications.
6. e. Fluoride is beneficial to all age groups.
7. e. Primary prevention occurs before disease occurs. Remineralization is reversing early stages of the disease, and is considered secondary prevention.
8. b. Oral disease is multifactorial.
9. a. Identifying a target of an intervention requires this understanding.
10. c. Other responses are related to meso level or macro level social factors.

CHAPTER 9

1. d. To be considered successful, health education must result in consistent behavioral change.
2. b. The major stages of the Stages of Change Model are:
 - Precontemplation: unaware of the health problem, without any thought of need for change
 - Contemplation: aware of problem and thinking about the possibility of making a change
 - Decision/Determination: making a plan for change
 - Action: putting plan for change into action
 - Maintenance: continuing desired health action.
3. e. All of the phrases apply to focus groups.
4. d. Physiologic needs are basic survival requirements; ego/esteem needs are feelings of self-worth; social needs are needs for affectionate relationships and a place in one's culture, group, or family; self-fulfillment implies the ability to control one's needs rather than to be controlled by them and to achieve one's potential.
5. b. The Learning Ladder steps in sequence (from lowest to highest) are unawareness, awareness, self-interest, involvement, action, and habit.
6. a. The factors that enhance acceptance and adoption of a new idea, behavior, product, or service innovation include relative advantage (superior to a past idea), compatibility (consistent with the adopters' experiences and values), complexity (ease of use), trialability (can be experimented with or tried on a limited basis), and observability (successful tangible results can be seen).
7. c. The Consumer Information Processing Model makes two key assumptions: (i) people are limited in how much information they can acquire, use, and remember; and (ii) people combine bits of information into useable summaries and create decision rules to enable faster and easier choices. The application for health education is that

before people will use health information it must be available, considered useful and new, and be user-friendly.

8. a. Both statements refer to widely accepted learning principles.
9. b. Health literacy refers to the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions.

CHAPTER 10

1. Lesson plans ensure that all information and material required to meet specific learning goals are presented in the most effective order and effectively supported by carefully chosen instructional materials. Additionally, instruction is stabilized if different individuals, using the same lesson plan, can present the same topic and accomplish the same learning goals.
2. b. An educational goal is a broad, general statement that describes the overall purpose of a block of instruction.
3. c. An instructional objective is a specific statement that clearly describes a behavior that can be observed and assessed to determine whether a learning experience has been successfully completed. Demonstrate is an action verb describing a behavior that can be assessed. Know, appreciate, and understand are vague terms; they do not specify when the knowing, appreciating, or understanding has been achieved.
4. a. Instructional set establishes the mood for the learning experience and makes learners aware of what they are to learn and why it has value for them. Body is the lesson information itself. Closure summarizes the presentation and reviews major points.
5. When incorporated into a carefully designed lesson, student-made posters can be educational for both those who make them and those who view them and can be used as learning activities to reinforce and review learning points. Using these projects as competing artwork in "poster contests" is

not advised. There are legitimate concerns regarding placing students in competitive situations in which a prize is awarded. There are no assurances that the prizewinner develops a commitment to change and practices oral health behaviors.

6. These materials can be used for new information that may not yet be available in textbooks, opportunities for extra or specialized reading for students who want and can manage more detailed information material for classroom teaching displays, bulletin boards, scrapbook collection topics, panel discussions of controversial issues, as well as materials for career guidance.
7. e. In Middle Eastern cultures, the importance of what is being said is conveyed by the loudness with which it is spoken. The louder one speaks, the more important he perceives his message to be. Anger, in contrast, is usually expressed by an intense, high-pitched voice. Importance is also conveyed through multiple repetitions, as is characteristic in Muslim prayers.
8. d. Instructional planning is a purposeful, learner-centered activity, focusing on the target audience and their unique learning needs. Learning objectives, content, methods, materials, and activities are all chosen to accommodate need and ability.
9. Each strip is removed at the appropriate time, when the point is being discussed. The sequenced parts remain in view, showing how each part builds in relationship to the next.
10. b. Conversational distance space for Westerners is about 5 feet. For people from the Middle East, the appropriate distance is about 2 feet from the person with whom they are speaking. This closeness may make Westerners feel uncomfortable or “threatened” as others move in toward them during conversation.

CHAPTER 11

1. e.
2. c.
3. b.

4. c.
5. a.
6. False. Incidence requires that you know the number of new cases during a specific period. Dental caries rates in the United States are based on the percentage of people who have disease at a certain point in time, therefore they are prevalence rates.
7. d.
8. b.
9. d.

CHAPTER 12

1. d.
2. c.
3. a. True
4. b. False. It means that 25% of their teeth with gingival recession have decay or fillings on the roots.
5. d.
6. c.
7. b. False. The Simplified Oral Hygiene Index (OHI-S) is becoming obsolete as periodontal research focuses more on subgingival, rather than supragingival, plaque and calculus as risk factors for periodontitis.
8. c.
9. c.
10. d.

CHAPTER 13

1. b. False. Among children ages 6 to 18 years, the prevalence and total amount of both dental caries experienced and untreated decay has declined.
2. c. About 80% of permanent teeth affected by caries are found in about 25% of children ages 5 to 17 years.
3. a. True. For children ages 2–11 years, about 30% of lower income children have untreated decay in their primary dentition compared with 15% of higher income children. Among adolescents ages 12–19 years, 27% of lower income children have untreated decay compared with 13% of higher income children.
4. a, c & d. A higher proportion of males, compared to females, have untreated decay on

their coronal surfaces. Twenty-one percent of non-Hispanic Whites have untreated decay compared with 40% of non-Hispanic Blacks and 38% of Mexican Americans.

5. b. False. Between 1988–1994 and 1999–2004 there was an increase in dental caries in the primary teeth of children ages 2–5.
6. c. The prevalence of dental fluorosis in U.S. children increased between 1986–1987 and 1999–2002. The prevalence of dental fluorosis is higher in fluoridated compared to fluoride-deficient communities (29% vs. 16%). The majority (76%) of fluorosis cases can be classified as very mild.
7. c. Seventy-three percent of adolescents ages 13–17 years have gingival bleeding compared to 66% of 18–24 year olds and 60% to 63% of adults ages 25 years and older.
8. b. False. The prevalence of periodontal pocketing is relatively stable in adults ≥ 35 years.
9. b & e. Thirty-eight percent of males 20–64 compared with 27% of females had loss of attachment of ≥ 3 mm, while 13% of males compared with 8% of females had periodontal pockets of ≥ 4 mm. Seven percent of non-Hispanic Whites compared with 21% of non-Hispanic Blacks and 17% of Mexican Americans had periodontal pockets of ≥ 4 mm.

CHAPTER 14

1. Gender (a); because gender has two levels (male and female), it should be classified as a binary nominal categorical variable. Race (b); race can be categorized into many categories. However, because it has no natural order, it is a nominal categorical variable with more than categories. Temperature (d); temperature is a continuous variable.
2. a. The median is the midpoint of the distribution of numbers. To facilitate finding this point, first put the observations in order: 0, 2, 3, 4, 5, 8, 10, 10, and 12. The median is the $[(n + 1)/2]\text{th} = [(9 + 1)/2]\text{th} = 5\text{th value}$, which, in this case, is 5.
3. c. Follow the steps in Box 14-6 to calculate the standard deviation:

- A. Compute the mean of the observations:
The mean should be calculated using the formula $\bar{x} = \frac{x_1 + x_2 + \cdots + x_n}{n}$. In this case,

$$\text{the mean} = [(12 + 0 + 5 + 4 + 10 + 10 + 8 + 2 + 3)/9] = 6.0.$$

- B. Determine the squared difference between each observation x and the mean $\bar{x}$:

Observation	Deviation	Squared Deviation
x	$x - \bar{x}$	$(x - \bar{x})^2$
0	$0 - 6.0 = -6.0$	$(-6.0)^2 = 36.0$
2	$2 - 6.0 = -4.0$	$(-4.0)^2 = 16.0$
3	$3 - 6.0 = -3.0$	$(-3.0)^2 = 9.0$
4	$4 - 6.0 = -2.0$	$(-2.0)^2 = 4.0$
5	$5 - 6.0 = -1.0$	$(-1.0)^2 = 1.0$
8	$8 - 6.0 = 2.0$	$(2.0)^2 = 4.0$
10	$10 - 6.0 = 4.0$	$(4.0)^2 = 16.0$
10	$10 - 6.0 = 4.0$	$(4.0)^2 = 16.0$
12	$12 - 6.0 = 6.0$	$(6.0)^2 = 36.0$
Total:	0	138.0

- C. Calculate the variance by determining the mean squared deviation:

$$\begin{aligned}\text{Variance} &= \frac{\text{sum of squared deviations}}{\text{number of observations}} \\ &= \frac{138.0}{9} = 15.3\end{aligned}$$

- D. Determine the standard deviation by taking the square root of the variance:

$$\text{standard deviation} = \sqrt{\text{variance}} = \sqrt{15.3} = 3.91$$

4. a. Consult Table 14-3 to answer this question. There are three steps:
 - A. Determine the probability that $Z \leq -1.0$:
Although $Z \leq -1.0$ is not directly listed on the table, we can calculate it because we know that the probability that $Z \leq -1.0 = (1 - \text{Probability that } Z < 1.0)$. We can look up the probability that $Z < 1.0$ in the table; it is 0.8413. Hence, the probability $Z \leq -1.0 = 1 - 0.8413 = 0.1587$.
 - B. Determine the probability that $Z \leq -2.0$:
Following the same procedure as in Step A to determine that the probability that $Z < 2.0$ is 0.0227.

- C. Subtract (A) – (B) to determine probability that Z will lie between –2 and –1:
Probability that Z will lie between –2 and –1 is $0.1587 - 0.0227 = 0.1360 = 13.6\%$.
5. d. We can answer this question in three steps, outlined in Box 14-7.
- A. Calculate the risk in the exposed:
- The risk in the exposed is $\frac{50}{100} = 0.50$.
- B. Calculate the risk in the unexposed:
- The risk in the unexposed is $\frac{50}{150} = 0.33$.
- C. Divide (a)/(b):
- The risk ratio is $\frac{0.50}{0.33} = 1.52$. Simply, this study found that smokers are 1.52 times as likely as nonsmokers to have gingivitis or periodontitis.
6. a. As dmft increases, DMFT also increases. Thus, the linear relationship between the two variables can be described as positive.
7. d. To test this null hypothesis, we would use ANOVA/F-test (see Boxes 14-9 and 14-12).
8. b. Exposure is the presence of periodontal disease, and outcome is the development of coronary heart disease; thus, a risk ratio of 1.5 is interpreted to mean that those with periodontal disease are 1.5 times more likely to develop coronary heart disease than those who did not have periodontal disease. As the name implies, the risk ratio is a ratio, not a difference; on this basis, you should have rejected answers a and d.
9. c. Because the authors rejected the null, we are concerned that an alpha error (α error) may have been committed. Alpha errors occur if you reject the null when the null is true. We are not concerned about beta errors (β errors) because beta errors are only a concern when you fail to reject the null. Sampling error may or may not be a concern in this study; however, a sampling error is not a type of statistical error.
10. b. No. Given a sufficiently large number of subjects, even small, clinically insignificant relationships may be statistically significant.

As a clinician, it is your responsibility to judge whether a result is of clinical importance.

CHAPTER 15

- d.
- e. Presenting findings at a professional meeting is a link in the diffusion of information, but not one of four components of evidenced-based dentistry.
- a. Early adopters are the first to learn of innovations and to adopt them. As a result, they become opinion leaders for other later adopters and the public.
- c. Presentations are usually made at professional meetings soon after a study is completed and, possibly, not yet published.
- d. Clinical trials with control groups

CHAPTER 16

- a.
- d.
- b.
- b.
- c.
- c.
- b.
- d.
- e.
- c.

CHAPTER 17

- c.
- c.
- c.
- e.
- e.
- d.
- b.
- e.

CHAPTER 18

Refer to Review Questions in the chapter for correct responses

Appendix 2

FEDERAL GOVERNMENT AGENCIES/ ACRONYMS (FIGURE 1-2)

*Denotes components of the U.S. Public Health Service

Department of Health and Human Services (DHHS)

*(OPHS) *Office of Public Health and Science*

(USPHS) United States Public Health Service
Commissioned Corps

(OSG) Office of the Surgeon General
12 Core Public Health Offices

*(IHS) *Indian Health Service (Twelve Area
Offices listed in Figure 1-2)*

*(NIH) *National Institutes of Health*

(NCI) National Cancer Institute

(NEI) National Eye Institute

(NHLBI) National Heart, Lung, and Blood
Institute

(NHGRI) National Human Genome Research
Institute

(NIA) National Institute on Aging

(NIAAA) National Institute on Alcohol Abuse
and Alcoholism

(NIAID) National Institute of Allergy and
Infectious Diseases

(NIAMS) National Institute of Arthritis and
Musculoskeletal and Skin Diseases

(NIBIB) National Institute of Biomedical
Imaging and Bioengineering

(NICHD) National Institute of Child Health
and Human Development

(NIDCD) National Institute on Deafness and
Other Communication Disorders

(NIDCR) National Institute of Dental and
Craniofacial Research

(NIDDK) National Institute of Diabetes and
Digestive and Kidney Diseases

(NIDA) National Institute on Drug Abuse

(NIEHS) National Institute of Environmental
Health Sciences

(NIGMS) National Institute of General
Medical Sciences

(NIMH) National Institute of Mental Health

(NINDS) National Institute of Neurological
Disorders and Stroke

(NINR) National Institute of Nursing
Research

(NLM) National Library of Medicine
Seven Centers

(CIT) Center for Information Technology

(CSR) Center for Scientific Review

(FIC) John E. Fogarty International Center

(NCCAM) National Center for Complementary
and Alternative Medicine

(NCMHD) National Center on Minority
Health and Health Disparities

(NCRR) National Center for Research
Resources

(CC) Warren Grant Magnuson Clinical
Center

*(CDC) *Centers for Disease Control and
Prevention*

(COGH) Coordinating Office for Global
Health

(COTPER) Coordinating Office for Terrorism
Preparedness and Emergency Response

(CCEHIP) Coordinating Center for
Environmental Health and Injury
Prevention

(NCEH) National Center for Environmental
Health

(ATSDR) Agency for Toxic Substances and
Disease Registry

(NCIPC) National Center for Injury
Prevention and Control

(CCHIS) Coordinating Center for Health
Information and Service

(NCHM) National Center for Health
Marketing

(NCHS) National Center for Health
Statistics

(NCPHI) National Center for Public
Health Informatics

(CCHP) Coordinating Center for Health
Promotion

(NCBDDD) National Center on Birth
Defects and Developmental Disabilities

- (NCCDPHP) National Center for Chronic Disease Prevention and Health Promotion
- (CCID) Coordinating Center for Infectious Diseases
- (NCIRD) National Center for Immunization and Respiratory Diseases
- (NCZVED) National Center for Zoonotic, Vector-Borne, and Enteric Diseases
- (NCHHSTP) National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention
- (NCPDCID) National Center for Preparedness, Detection, and Control of Infectious Diseases
- (NIOSH) National Institute for Occupational Safety and Health
- *(HRSA) *Health Resources and Services Administration*
- (BPHC) Bureau of Primary Health Care
- (BHP) Bureau of Health Professions
- (MCHB) Maternal and Child Health Bureau
- (HAB) HIV/AIDS Bureau
- (BCRS) Bureau of Clinician Recruitment and Service
- (HSB) Healthcare Systems Bureau
- *(FDA) *Food and Drug Administration*
- (CBER) Center for Biologics Evaluation and Research
- (CDRH) Center for Devices and Radiological Health
- (CDER) Center for Drug Evaluation and Research
- (CFSAN) Center for Food Safety and Applied Nutrition
- (CVM) Center for Veterinary Medicine
- (NCTR) National Center for Toxicological Research
- *(AHRQ) *Agency for Healthcare Research and Quality*
- (CDOM) Center for Delivery, Organization, and Markets
- (CFACT) Center for Financing, Access, and Cost Trends
- (COE) Center for Outcomes and Evidence
- (CP3) Center for Primary Care, Prevention, and Clinical Partnerships
- (CQuIPS) Center for Quality Improvement and Patient Safety
- *(SAMHSA) *Substance Abuse and Mental Health Services Administration*
- (CSAT) Center for Substance Abuse Treatment
- (CSAP) Center for Substance Abuse Prevention
- (CMHS) Center for Mental Health Services
- *(NCEH/ATSDR) *National Center for Environmental Health/Agency for Toxic Substances and Disease Registry*
- (NCEH) National Center for Environmental Health
- (EEHS) Emergency and Environmental Health Services
- (EHHE) Environmental Hazards and Health Effects
- (DLS) Division of Laboratory Sciences
- (ATSDR) Agency for Toxic Substances and Disease Registry
- (DHAC) Division of Health Assessment and Consultation
- (DHS) Division of Health Studies
- (DTEM) Division of Toxicology and Environmental Medicine
- (DRO) Division of Regional Operations
- (AoA) *Administration on Aging*
- (CPM) Center for Policy and Management
- (CPO) Center for Program Operations
- (CMS) *Centers for Medicare & Medicaid Services*
- (CDHPC) Center for Drug and Health Plan Choice
- (CMM) Center for Medicare Management
- (CMSO) Center for Medicaid and State Operations
- (ACF) *Administration for Children and Families*
- (OHS) Office of Head Start
- (OFA) Office of Family Assistance
- (OPA) Office of Public Affairs

(OPRE) Office of Planning, Research, & Evaluation

(OCSE) Office of Child Support Enforcement

(ORR) Office of Refugee Resettlement

(OCS) Office of Community Services

(OLAB) Office of Legislative Affairs and Budget

(ORO) Office of Regional Operations

(ADD) Administration on Developmental Disabilities

(ANA) Administration for Native Americans

(ACYF) Administration on Children, Youth, and Families

Appendix 3

AMERICAN DENTAL EDUCATION ASSOCIATION COMPETENCIES FOR ENTRY INTO THE PROFESSION OF DENTAL HYGIENE

(Note: At time of publication, these Competencies were being considered for future revision by ADEA.)

CHAPTER(S)	COMPETENCY ADDRESSED
	Core Competencies (C)
16, 17	C.1 Apply a professional code of ethics in all endeavors.
3, 17	C.2 Adhere to state and federal laws, recommendations, and regulations in the provision of dental hygiene care.
2, 5, 6, 7, 8, 16	C.3 Provide dental hygiene care to promote patient/client health and wellness using critical thinking and problem solving in the provision of evidence-based practice.
3, 5, 6, 7, 8, 12, 13, 14, 15	C.4 Use evidence-based decision making to evaluate and incorporate emerging treatment modalities.
1, 2, 3, 5, 6, 8, 9, 14, 15	C.5 Assume responsibility for dental hygiene actions and care based on accepted scientific theories and research as well as the accepted standard of care.
4, 16, 18	C.6 Continuously perform self-assessment for lifelong learning and professional growth.
3, 4, 5, 8	C.7 Promote the profession through service activities and affiliations with professional organizations.
1, 7, 11, 14	C.8 Provide quality assurance mechanisms for health services.
2, 8, 9, 10	C.9 Communicate effectively with individuals and groups from diverse populations both verbally and in writing.
7, 15, 17	C.10 Provide accurate, consistent, and complete documentation for assessment, diagnosis, planning, implementation, and evaluation of dental hygiene services.
6, 8, 9, 10, 16	C.11 Provide care to all clients using an individualized approach that is humane, empathetic, and caring.
	Health Promotion and Disease Prevention (HP)
1, 2, 4, 5, 6, 8, 9, 10	HP.1 Promote the values of oral and general health and wellness to the public and organizations within and outside the profession.
6, 8, 9, 10, 16	HP.2 Respect the goals, values, beliefs, and preferences of the patient/client while promoting optimal oral and general health.
16, 17	HP.3 Refer patients/clients who may have a physiologic, psychological, and/or social problem for comprehensive patient/client evaluation.
2, 5, 6, 7, 8, 9, 10,	HP.4 Identify individual and population risk factors and develop strategies that promote health related quality of life.
6, 7, 8, 9, 10, 14	HP.5 Evaluate factors that can be used to promote patient/client adherence to disease prevention and/or health maintenance strategies.
5, 6, 7, 8, 9	HP.6 Evaluate and utilize methods to ensure the health and safety of the patient/client and the dental hygienist in the delivery of dental hygiene.

Community Involvement (CM)	
1, 2, 4, 5, 6, 8, 9, 11, 12, 14	CM.1 Assess the oral health needs of the community and the quality and availability of resources and services.
5, 6, 7, 8, 9, 10, 18	CM.2 Provide screening, referral, and educational services that allow clients to access the resources of the health care system.
1, 2, 3, 4, 5, 6, 8, 9, 10	CM.3 Provide community oral health services in a variety of settings.
1, 2, 3, 4, 5, 6, 8	CM.4 Facilitate client access to oral health services by influencing individuals and/or organizations for the provision of oral health care.
2, 3	CM.5 Evaluate reimbursement mechanisms and their impact on the patient's/client's access to oral health care.
5, 6, 7, 8, 9, 11, 12, 13, 14, 18	CM.6 Evaluate the outcomes of community-based programs and plan for future activities.
Patient/Client Care (PC) Assessment	
17	PC.1 Systematically collect, analyze, and record data on the general, oral, and psychosocial health status of a variety of patients/clients using methods consistent with medico-legal principles.
<i>Diagnosis</i>	
5, 6, 8, 9, 13	PC.2 Use critical decision making skills to reach conclusions about the patient's/client's dental hygiene needs based on all available assessment data.
<i>Planning</i>	
5, 6, 8, 9, 10, 17	PC.3 Collaborate with the patient/client, and/or other health professionals, to formulate a comprehensive dental hygiene care plan that is patient/client-centered and based on current scientific evidence.
<i>Implementation</i>	
5, 6, 8, 9, 10	PC.4 Provide specialized treatment that includes preventive and therapeutic services designed to achieve and maintain oral health. Assist in achieving oral health goals formulated in collaboration with the patient/client.
<i>Evaluation</i>	
7, 8, 9, 11, 12	PC.5 Evaluate the effectiveness of the implemented clinical, preventive, and educational services and modify as needed.
Professional Growth and Development	
1, 2, 3, 4	PGD.1 Identify career options within health care, industry, education, and research and evaluate the feasibility of pursuing dental hygiene opportunities.
2, 8, 9, 10	PGD.2 Develop practice management and marketing strategies to be used in the delivery of oral health care.
1, 2, 3, 4, 5, 6, 8, 9, 15	PGD.3 Access professional and social networks to pursue professional goals.

Glossary

abandonment—withdrawing a patient's medical or dental care without providing sufficient notice to the patient

Aboriginal health workers—health care providers trained to provide basic health care services to remote aboriginal populations in Australia

abstract—a brief synopsis of a scientific report, study, or program, which allows the readers to determine if the information is relevant to their interests

access to care—an individual's ability to obtain needed health care services

activities—the component steps required to perform an intervention

administrative law—a branch of law that includes regulations developed by government agencies

agent—a factor (e.g., a microorganism) by which the presence or absence (in deficiency diseases) is essential for disease occurrence

alternative hypothesis (H_A)—a statement that there is a relationship between an exposure and an outcome

American Association of Public Health Dentistry (AAPHD)—a professional organization of dental public health professionals and individuals concerned with improving the public's oral health

American Board of Dental Public Health (ABDPH)—the national examining and certifying agency for the American Dental Association specialty of dental public health

American Dental Education Association (ADEA)—a professional organization representing dental educators and administrators

American Dental Hygienists' Association (ADHA)—the national professional organization representing dental hygienists in the United States

American Public Health Association (APHA)—the largest organization of public health professionals worldwide, representing members from more than 50 occupations

Analysis of Variance (ANOVA)—a statistical test that compares means across three or more categories; used when one variable is normally distributed (continuous) and one is multiple categorical

Analytic studies—examine associations or hypothesized causal relationships; generally concerned with identifying or measuring the effects of certain risk factors

anticipatory guidance—counseling a family about a child's current oral health status and what can be expected at upcoming developmental stages

assault—a willful attempt or threat to inflict injury; an intentional display of force to cause fear; can be committed without touching or striking

assignment—a classification of delegation or management by a dentist for a dental hygienist or dental assistant; used in some jurisdictions; dentist need not be present

associated/association—a statistical dependence between two or more events or characteristics; an association may be positive or negative

Association of State and Territorial Dental Directors (ASTDD)—a national nonprofit organization representing the directors and staff of state public health agency programs for oral health

ASTDD Seven-Step Model—a needs assessment tool; can be accessed through the ASTDD web site

Atraumatic Restorative Technique (ART)—a nontraumatic procedure, which usually involves removal of necrotic tooth structure with hand instruments, and placement of a temporary glass ionomer or composite restorative material

attitudes—intermediate variables that influence health

Autonomy—a principle of self-determination; respect

bar chart—a graphical representation of the frequency distribution of a categorical variable

- barriers**—factors that hinder an individual from optimal health (e.g., social, psychological, physical)
- Basic Screening Survey (BSS)**—a model for oral health surveillance developed by the ASTDD
- battery**—offensive touching of a person without the person's consent, which results in bodily harm
- Behavioral Risk Factor Surveillance System (BRFSS)**—a state-based, ongoing data collection program designed to measure behavioral risk factors in adults in the United States
- behaviors**—intermediate variables that influence health
- beneficence**—principle of promoting what is good, kind, and charitable
- beyond a reasonable doubt**—highest level of proof required; necessary for a guilty verdict in a jury case
- bias**—the error in the estimation of a quantity that is not attributed to chance
- bioethics**—moral dilemmas and issues that result from advances in medicine and medical research
- body**—the component of a lesson plan that presents all major learning points; constitutes the bulk of the lesson information
- calibration**—Adjustment of an instrument/examiner or its measurements so the distribution of measurements matches a standard
- Canadian Association of Public Health Dentistry (CAPHD)**—a Canadian national professional organization representing dental public health and related professionals
- capitation**—when managed care plans or clinics are paid a fixed amount per enrollee per month, regardless of whether that individual actually uses the services offered
- case-control**—a study design in which persons with the disease of interest (cases) are compared with those without the disease (controls) in terms of exposure to some attribute or risk factor
- causative factors**—factors associated with the development of disease
- Children's Health Insurance Program (CHIP)**—jointly funded federal-state program that provides health insurance coverage for children up to age 19 whose families do not qualify for Medicaid and whose incomes are generally less than twice the federal poverty level
- civil law**—law concerned with civil or private matters, not criminal matters; includes torts and contract agreements
- cleft lip**—congenital defect of the lip; a fissure extending from the margin of the lip to the nostril; may be single or double
- cleft palate**—congenital failure of fusion between the right and left palatal processes
- closure**—the component of a lesson plan that summarizes the presented material; reviews main points and gives a sense of unity to the lesson as a whole
- cluster sampling**—a nonprobability sampling in which the sample is divided into clusters, defined by geography or time, and a simple random sample is drawn from each cluster
- code of ethics**—a set of rules or guidelines that provides a framework for the behavior of a professional group
- cohort**—any designated group of persons followed or traced for a period
- collaborative practice**—model of oral health care delivery in which the dental hygienist provides educational, assessment, preventive, clinical, and therapeutic services without general supervision
- Commissioned Corps (USPHS)**—U.S. Public Health Service Commissioned Corps is a non-arms-bearing uniformed service of the U.S. Government; a career system for health professionals
- common good**—a focus on collaboration to benefit the larger good or that of the community
- common risk factors**—risk factors that are common to multiple diseases or conditions
- community**—a group of people who live in a common geographic area or who have similar interests or needs
- community coalitions**—cooperative effort between partners to maximize efforts toward a common goal
- community-based participatory research**—Research where the community is an equal partner in identifying research priorities and in all phases of projects

community focus—a health education approach that addresses the behavioral impact of economy, politics, or other factors within the community; focuses on using community strengths to solve problems not effectively addressed by individuals or small groups

community needs assessment—an initial program planning step that determines to what extent certain needs exist and their salience compared with other problems and needs

Community Organization Theory—a behavioral theory that emphasizes development and active community participation to evaluate and solve health and social problems

Community Periodontal Index (CPI)—a measure of periodontal health; developed and supported by the World Health Organization (WHO)

community profile—a demographic description of a community, including total population, number of households, size, age distribution, household income, marital status, racial/ethnic composition, education geographic boundaries, political and economic atmosphere, and dental and medical resources

community water fluoridation—the process that optimizes fluoride levels in a community's water supply

compliance—acting in accordance with recommendations

confidence intervals—estimates a range of values likely to contain the true population parameter of interest

confidentiality—entrusted or held secret

confounding—a specific type of bias; occurs when a variable is related to the outcome of interest and is more likely to be present in one of the exposure groups

confounding variables—factors that can cause or prevent the outcome (disease) of interest

consideration—in contract law; something of value provided as part of an agreement

Consumer Information Processing Model—a marketing theory based on how consumers take in and use information when making decisions; it presumes that people are limited in how much information they can acquire, use, and remember, and that they summarize

bits of information to enable faster and easier choices

contract law—the area of law that includes an enforceable agreement or obligation between two or more persons

convenience sample—a nonprobability sampling in which subject selection is based on researcher convenience, rather than any subject characteristic

core public health functions—a set of core functions for public health agencies developed by the Institute of Medicine; centered on assessment, policy development, and assurance

correlation coefficient—a description of strength and direction of the linear relationship between two continuous or ordinal categorical variables

cost-benefit ratio—the difference between the expense of having a program versus the expense of not having the program

cost-effective—a program or intervention demonstrates enough benefit to justify the cost

count—the number of occurrences of a disease

critical review—an assessment of the quality level of a scientific report

cross-sectional study—examines the relationship between disease and risk factors in a defined population at one particular time

cultural competence—possessing values and principles that allow one to interact effectively with individuals from different cultures

cultural knowledge—familiarity with the selected cultural characteristics of another ethnic group, including history, values, belief systems, and behaviors

cultural sensitivity—an awareness and respect of cultural differences and similarities

culturally relevant—incorporating a specific group's health beliefs, dietary considerations, and communication styles in a health message to make it more meaningful

damages—a monetary compensation awarded to a person who suffered loss or injury to their person, property, or rights; sum of money awarded to a person injured by tort

Dean's Fluorosis Index—measures the prevalence and severity of dental fluorosis

- deceit**—a deceptive misrepresentation to trick another; an untrue statement made with knowledge that it is false
- defamation of character**—published statement that injures a person's reputation
- defendant**—in civil cases, the person or organization that is sued; in criminal cases, the person being sued
- degrees of freedom**—the number of values in the calculation of a statistic that are free to vary
- dental caries**—demineralization of tooth enamel as a result of acid production by cariogenic bacteria
- dental fluorosis**—hypomineralization of the enamel as a result of excessive fluoride intake during tooth development
- Dental Health Aide Therapists (DHAT)**—A mid-level dental provider with an educational background that allows them to provide most preventive and some limited restorative procedures, depending upon the country in which they are employed
- Dental Health Professional Shortage Areas (DHPSA)**—geographic areas, special population groups, or facilities designated by the federal government as having a shortage of oral health personnel
- dental home**—a continuous, accessible source of comprehensive dental care
- dental nurses/therapists**—oral health care providers educated and trained to provide basic dental procedures
- dental practice act**—a single law, or compilation of laws, that regulates the practice of dentistry, dental hygiene, and dental assisting or other auxiliary individuals providing dental services
- dental public health**—one of nine dental specialties; focuses on the science and art of preventing and controlling dental diseases and promoting dental health through organized community efforts
- Deontological ethics**—ethical theory that focuses on the morality, rather than the consequences of action
- dependent variables**—the outcome(s) of interest in a study
- descriptive statistics**—numeric characteristics of a sample of a population of interest
- descriptive study**—describes the existing distribution of disease and other variables, without regard to causal or other hypotheses
- df Index**—a measure of dental caries in the primary dentition that includes decayed and filled primary teeth of tooth surfaces (dft/dfs)
- Diffusion of innovations**—a behavioral theory that describes how new ideas, social practices, or products spread through a society or from one society to another
- direct activities**—the steps directly involved in the delivery of an intervention
- direct supervision**—a classification of delegation or management by a dentist for a dental hygienist or dental assistant; involves examination and diagnosis by a licensed dentist; dentist may be required to examine the patient before and after a procedure is completed
- discussion**—the section of a scientific report that presents study or program conclusions and discusses the relevance of the information presented
- dmf Index**—a measure of dental caries in the deciduous dentition that includes decayed, missing, and filled deciduous teeth or tooth surfaces (dmft/dmfs)
- DMF Index**—a measure of dental caries in the permanent dentition that includes decayed, missing, and filled permanent teeth or tooth surfaces (DMFT/DMFS)
- duty**—obligation or responsibility
- educational goal**—a nonspecific statement that serves as a foundation upon which to develop all subsequent educational plans
- efficacious**—produces a desired effect
- efficiency**—producing a desired result with minimum effort, expense, or waste
- enabling factors**—factors related to a health problem or behavior that enable, or make it possible for, actions to occur; includes personal skills and available resources needed to perform a behavior
- endemic**—the constant presence of disease within a given population or geographic area
- environmental factors**—factors external to the individual human host that can influence disease

- epidemic**—the occurrence of disease in a given population or geographic area that clearly exceeds normal expectancy
- epidemiology**—the study of the distribution and determinants of disease and injuries in human populations
- ethical decision framework**—a process to resolve an ethical dilemma, which considers ethical principles, codes of conducts, relevant facts, and results in an appropriate, ethically based alternative
- ethical dilemma**—a situation that involves two or more important, opposing, ethical principles
- ethics**—a branch of philosophy relating to morals or moral principles; rules or governing standards
- evidence-based dentistry (EBD)**—oral health care that requires judicious integration of systematic assessments of clinically relevant scientific evidence relating to the patient's oral and medical condition and history with the provider's clinical expertise and the patient's treatment needs and preferences
- evidence-based practice**—integrating new evidence for effectiveness with expert opinion, clinical and community experience, and professional judgment
- experimental study**—a study in which the investigator directly controls the conditions
- express contract**—when both parties agree (written or oral) to the terms of an agreement
- extrinsic motivation**—the desire to change a behavior, based on external factors
- false imprisonment**—intentional, illegal detention, or unjustified restraint of one's liberty or freedom of motion
- Federal Poverty Level (FPL)**—an annual measurement of poverty in the United States issued by the Department of Health and Human Services (DHHS); that is, in 2003, the poverty guideline for a family of 4, in the 48 contiguous states, was \$18,400
- fidelity**—principle of loyalty or faithfulness; keeping promises
- financial barriers**—limited access for patients because of their inability to pay for a service or because providers choose not to provide care for those with limited finances
- flow charts**—a diagram illustrating the flow of information through a system or program
- fluoride tablets**—A specific dosage of fluoride in tablet form that was originally designed to be dissolved in water and drank throughout the day; most commonly consumed in pill form
- fluoride varnish**—a preventive procedure in which a highly concentrated varnish is painted directly on the teeth
- focus groups**—a marketing technique used for understanding consumer behavior that uses a small group of people in a guided discussion to collect information, including community needs, attitudes, and norms
- formative evaluation**—the measurement of program activities during implementation to determine problems and identify improvement opportunities
- fraud**—deception or misrepresentation, with intent to harm another or deprive them of their rights
- frequency table**—lists the number of observations in different value ranges
- gatekeeper**—the primary care provider (e.g., general dentist) who controls referrals to specialists
- general supervision**—a classification of delegation or management by a dentist for a dental hygienist or dental assistant that may require the dentist's examination and diagnosis for a procedure to be completed
- Gingival Index (GI)**—a measure of the prevalence and severity of gingival bleeding
- gingivitis**—reversible inflammation of gingival tissue
- health**—a state of complete physical, mental, and social well-being; not merely the absence of disease or infirmity
- Health Belief Model**—a health behavior theory that suggests that behaviors are directed by perceptions and beliefs of susceptibility, severity, beneficial behaviors, and the absence of barriers to action; suggests that whether a person engages in preventive health actions depends on these beliefs

health communication—the study and use of communication strategies to inform and influence individual and community decisions that enhance health

health education—educational interventions designed to help individuals or groups learn new health information and health behaviors; a process of communicating evidence-based methods of disease prevention and encouraging responsibility for self-care

health habits—repeated behaviors that influence health; either positive or negative (i.e., a regular exercise routine can be a positive health habit; however, smoking is considered a negative health habit)

health information literacy—the ability to recognize a health information need; identify likely information sources and use them to retrieve relevant information; assess the quality of the information and its applicability to a specific situation; and analyze, understand, and use the information to make good health decisions

Health Insurance Portability and Accountability Act (HIPAA)—A 1996 Act with three purposes: (i) to help employees keep continuous health care coverage for themselves and their dependents if they leave one job for another; (ii) to protect confidential medical information from unauthorized disclosure and/or use; and (iii) help curb the rising cost of fraud and abuse through streamlining of codes and billing procedures

health promotion—the science and art of helping change the lifestyle of individuals and society to attain optimal health, which places an emphasis on improving quantity and quality of life for all and enables people to improve their health, including the use of any preventive, educational, or administrative policy, program, or law

Healthy People—a national health promotion and disease prevention initiative for the United States that includes identification of the most significant, preventable threats to health and elimination of health disparities among different population segments

Healthy People 2010 ToolKit—a planning guide, including technical tools and resources, to help states, territories, and tribes develop and promote successful, state-specific Healthy People 2010 plans

histogram—a graphical representation of a continuous variable frequency distribution

host factors—factors within the individual human host that can influence disease

hypothesis testing—a systematic, quantitative way to judge the evidence for a hypothesis

impact—the effect of a program on the community's health

implied contract—agreement inferred by the signs, inaction, or silence of a patient

implied duties—a responsibility of a provider to a patient, or patient to a provider, that is not specifically stated or written, but inferred by actions or status

incidence—the number of new disease cases within a specified period

independent variables—the exposure(s) of interest in a study

index—a graduated, numeric scale with upper and lower limits; scores on the scale correspond to specific criteria

Indian Health Service (IHS)—a DHHS agency that provides comprehensive, personal and public health services for American Indian and Alaska Native peoples

indirect activities—supportive activities required to carry out an intervention, such as equipment maintenance

indirect supervision—a classification of delegation or management by a dentist for a dental hygienist or dental assistant that may require examination and diagnosis by a dentist for a procedure to be completed; dentist must be on the premises

inferential statistics—analyses to determine whether results in a sample should be generalized to the entire population of interest

informed consent—an act (obtained orally and/or in writing) providing appropriate information to and obtaining the understanding of a patient regarding proposed treatments, risks, options, potential outcomes, and reasons for the recommended

- treatment, with an opportunity to answer the patient's questions
- informed refusal**—an act of providing appropriate information to and obtaining a decision to decline proposed treatment by a patient; if treatment is declined, information should include oral and general health risks and outcomes
- initiative**—a process in which an action is placed on the ballot by the request of a group of citizens
- in-kind support**—nonmonetary effort provided by an agency, or other entity, to illustrate a match for a portion of requested funds
- Institute of Medicine**—a nonprofit organization created to provide science-based advice on biomedical science, medicine, and health
- Institutional Review Boards (IRB)**—committees designated to review, approve, and monitor biomedical and behavioral research that involves humans as research subjects; consist of statisticians, researchers, community advocates to review the protocols to determine that the process is ethical and protects the rights of the participants
- instructional media**—the teaching materials and delivery formats used to augment instruction and assist in achieving learning objectives
- instructional objectives**—very specific statements that describe what the learner is expected to be able to do, know, or think differently about when lesson content has been provided and successfully completed
- instructional planning**—an organized approach to develop learner-appropriate educational plans that includes target audience analysis, formulation of learning objectives, identification of relevant subject content, selection of teaching methods, and selection of supporting materials, and learning experiences
- instructional set**—the component of a lesson plan that establishes the climate for an educational presentation and is intended to make learners aware of what it is they are to learn and to cause them to want to learn it
- integration of oral health and general health**—the understanding that the mouth is an integral part of the whole body and that oral health is an important aspect of overall health
- intentional tort**—a civil wrong that occurs when an individual intended the results of an action or actions
- interdisciplinary**—when two or more professions are playing equal, often substitutionary or complementary, roles
- interexaminer reliability**—The level to which different examiners agree
- Interim Therapeutic Restoration (ITR)**—procedure involving removal of caries using hand- or slow-speed rotary instruments with caution not to expose the pulp; restored with an adhesive restorative material such as a glass ionomer cement
- International Federation of Dental Hygienists (IFDH)**—an international, nongovernmental, nonprofit organization uniting dental hygiene associations from around the world in their common cause of promoting dental health
- interpersonal focus**—a health education approach that focuses on groups as targets of change; typically, uses small-group strategies to effect change
- interval variables**—a specific type of continuous variable
- Interventions**—program elements that are task-oriented and designed to respond to a problem or identified need
- intraexaminer reliability**—the level to which an examiner agrees with himself/herself at two different points in time
- intrapersonal focus**—a health education approach that focuses on the individual as the target of change; typically uses behavior modification techniques to effect changes in knowledge, attitudes, or beliefs
- intrinsic motivation**—incentive to change behavior, based on personal internal factors
- job descriptions**—a list of activities, roles, and duty divisions required in a staff position
- juried**—indicates that certain information or publications have been reviewed for scientific merit by experts in the field of study
- justice**—fairness; treatment without discrimination

- knowledge**—intermediate variables that influence health
- laws**—a body of rules of action or conduct, prescribed by a governmental authority, that has a binding legal force
- layout**—the basic compositional form of an educational display; incorporates the characteristics of balance, emphasis, harmony, and contrast
- leadership development**—opportunity for developing a vision for the future, including the administration and advocacy skills that will translate that vision into action
- Learning Ladder**—a learning theory concept suggesting that people learn in a linear series of sequential steps, moving away from ignorance toward acquisition of information and adoption of a new behavior; also known as Decision-Making Continuum
- learning style**—a characteristic way of processing information and way of feeling and behaving in learning situations
- lesson plan**—a well-organized, written guide for presenting a specific block of instruction
- leveraging resources**—expanding program potential by combining resources with other programs, working in coalitions or with partners to accomplish mutual goals
- libel**—false or injurious written statements or materials, including photographs or videos, that are maliciously published
- linear regression**—a method to assess the relationship between a single, continuous outcome variable and one or more exposure variables, which may be continuous or categorical
- literacy**—the ability to read, write, and speak a language and to compute and solve problems at the levels of proficiency necessary to function on the job and in society
- literature review**—a comprehensive analysis and synopsis of the literature available on a particular topic
- literature search**—a search of medical, dental, or other scientific literature databases to gather information about a particular topic
- loan forgiveness program**—the payment of a dental professional's student loans after graduation by a facility, federal/state program, or other entity in exchange for the dental professional serving a specified period in an underserved area
- logic model**—a planning model that graphically illustrates the relationship between a program's ultimate aim and the strategies and activities used, with an outline of how progress is measured
- logistic regression**—a method that assesses the relationship between a single, binary outcome variable and one or more exposure variables, which may be continuous or categorical
- macro level**—social factors that influence society and cultural and political agencies
- managed care plans**—plans that involve an arrangement between the insurer and a selected network of health care providers, and that offer policyholders financial incentives to use the providers in that network
- management information systems**—the organization of program data for program management and decision-making
- mapping**—a tool that identifies trends, patterns, and opportunities in a population; uses geographical information systems to provide analysis and display of health-related data sets on maps
- Maslow's Hierarchy of Needs**—a human motivation theory that suggests inner forces (needs) drive a person into action and that some needs take precedence over others; suggests a hierarchical arrangement of needs as motivating factors
- Maternal and Child Health (MCH)**—the Health Resources and Services Administration bureau responsible for services and programs to assure the health of American mothers and children
- mean**—one measure of central tendency of a continuous variable; the sum of the values of the observations divided by the number of observations
- media advocacy**—strategic use of various media outlets and formats (e.g., TV and newspapers) to increase issue awareness and knowledge
- median**—one measure of central tendency of a continuous variable; the middle observation

in a set of observations arranged in increasing order; 50th percentile

Medicaid—a jointly funded, federal-state health and dental insurance program for certain low-income and needy people

Medicare—a federal program that provides health insurance coverage for those who are ages 65 and older, certain people with disabilities, and persons with kidney failure

MEDLINE—see PubMed

meso level—social factors involving institutions, organizations, and social networks

methodology—the section of a scientific report that describes how the program, study, or evaluation was performed

micro level—social factors that influence an individual

milk fluoridation—the addition of fluoride to milk to prevent dental caries

mission statement—a single statement that expresses a broad, overarching purpose for a program's existence

mobile and portable dental services—providing dental services from self-propelled mobile vans, mobile trailers that are parked at sites, or portable dental equipment that fits into an automobile or truck and can be set up in a home or other setting

Mobilizing for Action Through Planning and Partnerships (MAPP)—a community-wide, strategic planning tool for improving community health

mode—one measure of central tendency of a continuous variable; the most frequent value in a set of observations

moral values—standards of conduct and thought influenced by family, religion, culture, and society

morbidity—sickness, illness

mortality—death

multifactorial—caused by more than one factor (e.g., dental caries is multifactorial because more than a single factor must be present to cause a lesion)

multiple causation—the concept that a given disease may have more than one cause

National Center for Health Statistics (NCHS)—the principal health statistics

agency in the United States responsible for compiling statistical information to guide actions and policies to improve the health of US citizens

National Health and Nutrition Examination Survey (NHANES)—an ongoing, national health survey conducted by the NCHS; part of the Centers for Disease Control and Prevention

National Institute of Dental and Craniofacial Research (NIDCR)—the primary oral health research institute at the National Institutes of Health

National Practitioner Data Bank (NPDB)—created to encourage State licensing boards, hospitals, and other health care entities to identify and discipline those that are involved in unprofessional behavior; to restrict the ability of incompetent health care providers to move from State to State without disclosure or discovery of previous medical malpractice and adverse action history

National Spit Tobacco Education Program (NSTEP)—an Oral Health America program aimed at preventing people, especially young people, from starting spit tobacco use and at helping all current users to quit

needs—services, conditions, and items required for health

needs analysis—a thoughtful prioritizing of problems

negligence—failure to perform professional duties to an accepted standard of care; carelessness

nominal variables—a categorical variable in which the categories cannot be put into any order (e.g., eye color)

nonmaleficence—principles of nonharm

nonprobability samples—a sample chosen in such a way that the probability of selecting a given subject from the population is unknown

normal distribution—bell-shaped distribution; mean = median = mode; 95% of all observations fall within two standard deviations of the mean

null hypothesis (H_0)—a statement that there is no relationship between an exposure and an outcome

- observational study**—a study design that does not involve intervention
- oral and pharyngeal cancer**—cancer of the lip, tongue, floor of the mouth, palate, gingiva and alveolar mucosa, buccal mucosa, or oropharynx
- oral epidemiology**—the study of the distribution and determinants of oral disease and injury in human populations
- oral health disparities**—certain population subgroups, defined by demographic factors, experience higher levels of oral disease
- oral health education**—a planned package of information, learning activities, or experiences that are intended to produce improved oral health
- oral presentation**—a method of communicating scientific findings to an audience, usually at professional meetings
- ordinal variables**—a multiple categorical variable in which the categories can be sequentially arranged (e.g., never smoker, past smoker, current smoker)
- Organizational Change Theory**—a theory suggesting that organizations move through stages, or a series of steps, as they initiate and adopt changes to improve the problem-solving and renewal processes of large organizations or entire communities
- organizational diagram**—a graphic illustration of a group, department, or agency's chain of command and information flow
- original source**—the initial publication of an article by the original author
- Ottawa Charter for Health Promotion**—developed at the WHO First International Conference on Health Promotion (1986) in Ottawa, Canada
- outcome evaluation**—see summative evaluation
- p-value**—the probability of obtaining the observed data (or data that are more extreme) if the null hypothesis were true
- Pan American Health Organization (PAHO)**—an international public health agency that includes all 35 countries in the Americas
- pandemic**—a worldwide epidemic
- parameter**—a numeric characteristic of an entire population of interest
- partners/partnerships**—two or more people or groups joined in an activity
- patient navigators**—people who help bridge the communication gap between patients and health care/dental care systems to assure that people are aware of information, services and financial coverage, and know how to access and use them
- peer-reviewed**—indicates that certain information or publications have been reviewed for scientific merit by experts in the field of study
- percentiles**—measures the spread of a continuous variable; a number that corresponds to a division of the range of a continuous variable, which is the value of the variable not exceeded by a specific percentage of all of the values in the sample (e.g., 75% of all values are below the value which defines the 75th percentile)
- periodontitis**—inflammation and infection of the ligaments and bones supporting the teeth
- personal/cultural barriers**—factors that inhibit patients from seeking care or following provider recommendations, based on personal or cultural beliefs
- pilot test**—a method or small preliminary test for ensuring a program or survey is usable; determines if questions are interpreted as intended and that given answers include all possibilities
- plain language**—writing materials that enable people to quickly and easily find the needed information, understand what they read, and act on that understanding
- plaintiff**—person who initiates a lawsuit
- planning models**—structured guides or tools used when developing community programs
- Plaque Index (PII)**—measures the presence and amount of dental plaque
- poster**—a poster board display created to express an idea or results of a study to an audience
- postprogram**—evaluation outcomes assessed after a program is completed
- power**—probability of rejecting the null when the null is false; $(1 - \beta)$ error)

Precede-Proceed Model—a planning model designed to explain health-related behaviors and to design and evaluate the interventions designed to influence both the behaviors and the living conditions that influence them and their sequelae

predictive value—for screening and diagnostic tests, the probability that a person with a positive test is a true positive (has the disease)

predisposing factors—factors related to health problems or behaviors that form the basis of, or motivation for, a behavior, including knowledge, beliefs, attitudes, values, cultural mores and folkways, and existing skills

preponderance of evidence—level of proof required to be successful in a civil action; jury must be at least 50% certain

preprogram and postprogram—measurements taken prior to a program or intervention are compared with measurements taken at the conclusion

preprogram and postprogram with a comparison group—measurements include the assessment of a group similar to the target group, but who did not receive the program; both target and comparison groups are assessed prior to the program, the program is delivered to the target group, and then both groups are assessed at the conclusion of the program

preprogram and postprogram with a control group—an evaluation design method with random assignment from a target population to either a control or intervention group; both groups are assessed prior to the program/intervention and at the conclusion

prevalence—the number of disease cases in a population at a given time

Prevent Abuse and Neglect Through Dental Awareness (P.A.N.D.A.)—a public-private partnership committed to educating dental professionals on how to recognize and report suspected cases of child abuse

prevention—the act of preventing a disease or its sequelae

primary data—information collected on a target population for use in program development

primary prevention—the intervention in disease before it occurs (e.g., community water

fluoridation, fluoride varnish, pit and fissure sealants, and preventive education)

probability sampling—a sample chosen with a known probability of including a given subject from the population of interest

process evaluation—see formative evaluation

profession—a group of individuals with specialized knowledge, requiring advanced skill and knowledge, that is self-regulating and guided by a code of ethics

professional responsibility—the obligation to fulfill specific requirements to maintain the expertise and knowledge associated with the profession

professionalism—representing qualities inherent in a professional, including technical skill, autonomy, self-monitoring, and adhering to a code of ethics

program evaluation—a measurement of intervention results against program objectives to determine whether a program successfully reduced or eliminated the identified need or problem

program goals—broad-based statements of desired long- or short-term changes to alleviate identified needs

program objectives—statements that define a desired change in the client or the environment

proportion—a ratio in which the numerator is included in the denominator

prospective—a study design in which a group of individuals (cohort) are followed forward in time

public health—concerned with the aggregate health of a group, community, state, or nation

public health care financing programs—health/dental insurance programs for certain low-income or otherwise needy people (e.g., Medicaid)

PubMed—an English language bibliographic database that allows free Internet access through the National Library of Medicine

qualitative—descriptive, explanatory information

quality of life—the depth of meaning of a given life

quantitative—objective and measurable information, usually numeric

quantity of life—the actual number of years an individual has lived

quartile—measures the spread of a continuous variable; one of three values which divides the sample of values into four equal portions; that is, the 25th (lower quartile), 50th (median), and 75th (upper quartile) percentiles

quota sample—a nonprobability sampling in which subjects in a block of predetermined size are selected

Ramford Index Teeth—six index teeth often used when evaluating periodontal health; maxillary right first molar, left central incisor, left first premolar, mandibular left first molar, right central incisor, and right first premolar

ratio variables—a specific continuous variable

readability—the ease with which the material can be read and understood; a measurement of the readability of written materials

refereed—indicates that information or publications have been reviewed for scientific merit by experts in the field of study

references—a list of sources used to prepare a presentation or written article

referendum—the process whereby an action by public officials is placed on the ballot for voter support

reinforcing factors—factors related to health problems or behaviors that provide incentive for the repetition or persistence of health behaviors once they have begun

reliable/reliability—different observers, looking at the same phenomenon, report similar levels; a particular technique applied repeatedly yields the same result each time

resources—available support (e.g., personnel, supplies, funds, buildings, and equipment)

results—the section of a scientific paper that states study or program outcomes

retrospective—a study design in which inferences about exposure are based on past events or experiences

risk assessment—identifying protective factors or those that may place a person at risk for developing oral disease

risk factors—factors that place an individual at risk for a disease (e.g., tobacco use is considered a risk factor for oral cancer)

Root Caries Index (RCI)—measures root caries; includes the number of exposed root surfaces as the denominator

round table—a method of presenting information in which participants discuss a topic in a small group setting

safety net dental clinics—community-based clinics that serve uninsured or underinsured people or those who do not receive care in the private sector

salt fluoridation—the addition of fluoride to salt to prevent dental caries

sample—a selection of subjects from a population of interest

school-based programs—deliver oral health care at schools or referred from schools to private practices; for children unlikely to receive dental care

school water fluoridation—the process whereby a school system optimizes the school water supply, with fluoride levels higher than recommended for community water supplies, to compensate for the limited hours per day attended

secondary data—survey or descriptive information that is available from other sources

secondary prevention—treating or controlling disease after it occurs, but early in its process (e.g., conservative amalgam restoration, remineralization of early caries, and conservative periodontal therapy)

secondary source—an article or study with quoted material from another source; not the initial author or source of information

sensitivity—the proportion of truly diseased persons in a screened population identified as having disease by the screening test

simple random sampling—a probability sample in which each subject has an equal and independent probability of being selected

Simplified Oral Hygiene Index (OHI-S)—measures the presence of plaque and calculus; considered an obsolete index

slander—false oral statements or gestures

Social Cognitive Theory—the dominant version of Social Learning Theory; proposes that behaviors are learned socially, through direct or vicarious experiences and through observation of others' actions, and the results of those actions

- social factors**—factors caused by society that affect the health of an individual or a group (e.g., an individual's health may be affected by a public policy)
- social justice**—fair distribution or allocation of resources to all members of society
- Social Learning Theory**—suggests that people learn through their own experiences, as well as by observing the actions of others and the results of those actions
- social marketing theory**—the adaptation of commercial marketing principles to the development of programs for influencing behavior of target audiences to improve physical and mental well-being and/or the society of which they are a part
- Social Security Act**—passed by Congress in 1935, establishing benefits for the elderly and unemployed and providing state aid for health and welfare activities
- socially equitable**—the same or equal treatment for everyone, despite socioeconomic standing, race, or ethnicity
- socioeconomic position**—a person's status, based on both social and economic conditions
- Special Olympics Special Smiles (SOSS)**—an international organization dedicated to empowering individuals with intellectual disabilities to become physically fit, productive, respected members of society through sports training and competition
- specificity**—the proportion of truly nondiseased persons in a screened population who are identified by the screening test as not having disease
- Stages of Change Model**—a health behavior theory suggesting that whether or not a person engages in preventive health actions depends on an individual's readiness to adopt a behavioral change; views behavioral change as a process, rather than an event, with people at varying levels of motivation or readiness to change
- stakeholders**—people, or groups, who have the potential to be affected or have a vested interest in a program
- standard deviation**—measures the spread of a normally distributed continuous variable; the average distance of each observation from the mean
- standard error**—an estimate of how well the sample statistic reflects the true population parameter of interest
- standard of care**—the ordinary skill and care expected of a reasonable, prudent practitioner
- statistical inference**—analytic methods to determine whether sample findings should be generalized to the entire study population of interest from which the sample was drawn, or whether chance is a probable explanation for the findings
- statistics**—estimates of a population parameter from a sample of that population; the science of making statements about an entire population from a limited sample
- statute of limitations**—the period that a patient has to file a lawsuit
- stratified random sample**—a sample constructed by drawing simple random samples from two or more subgroups in a population; ensures sufficient number of subjects in each subgroup
- structural barriers**—barriers to care related to the number, type, concentration, location, or organizational configuration of health care providers
- subject content**—the main focus of the lesson plan; the information collected, researched, and selected for presentation about the topic
- summative evaluation**—the judgment of the merit or worth of a program by a comparison of end results to goals
- Surgeon General's Report on Oral Health**—provides a comprehensive view of oral health in the United States and calls for public health professionals to address oral health issues
- surveillance**—the ongoing systematic collection, analysis, and interpretation of outcome-specific data for use in planning, implementing, and evaluating public health practices
- systematic reviews**—an overview of primary studies that uses explicit and reproducible methods to study a single research question
- t-test**—compares means between two categories; used when one variable is normally

distributed (continuous) and one is binary categorical

table clinic—a presentation method using a tabletop format; most appropriate for a hands-on demonstration

target audience—the intended learners for whom a specific educational plan is developed

target group/target population/targeting—the population segment identified to receive a public health intervention/program; limiting public health efforts to an identified group

technical battery—when a health care provider exceeds the provided patient consent

teledentistry—the use of electronic information and communications technology to provide and support health care delivered in distant locations

tertiary prevention—limiting disability from a disease or rehabilitation of an individual (e.g., a denture)

test anxiety—a type of performance anxiety; a feeling often experienced when performance really counts, when the pressure to do well has escalated to an unmanageable level

testlet—a short, descriptive scenario of a problem, situation, or event; differing from factual multiple choice questions in that the testlet format requires analysis and problem solving, rather than strict memorization

time line—a chart of events and procedures (e.g., target dates for completion of program activities)

title—a short description reflecting the content of an article; used as a guide by the reader and indexed for database reference

tooth loss—the loss of one or more permanent teeth

Tooth Surface Index of Fluorosis (TSIF)—a measure of prevalence and severity of dental fluorosis

tort law—the division of law that covers an act, or acts, that result in harm to another

total tooth loss—the loss of all natural permanent teeth (edentulous)

trends—consistent change over time

trespass—the act of going on another's property without expressed or implied consent

2 × 2 table—cross-tabulation of two binary variables

Type I error—rejection of the null when the null is true; alpha (α) error

Type II error—failure to reject the null when the alternative is true; beta (β) error

type fonts—lettering style; Common examples include Times New Roman, Courier, Arial, Verdana, and Tahoma

type size—the size of the lettering used for creating visual displays

unintentional tort—a civil wrong that occurs when an individual does not intend the results of the action

United States Public Health Service (USPHS)—an agency of the U.S. government responsible for monitoring and addressing health issues in the United States

unsupervised practice—treatment of a patient of record by a dental hygienist without a dentist on the premises; dental hygienist is practicing within an appropriate scope of practice

Utilitarian ethics—ethical theory based on the principle of the greatest good for the greatest number; consequence-based ethical theory

valid/validity—objective measurement (i.e., does an instrument actually measure what was intended)

variables—anything that can be measured or manipulated in a study

variance—measures the spread of a normally distributed continuous variable; equal to standard deviation squared

veracity—truthfulness and honesty; refraining from deception or misrepresentation

Virtue ethics—ethical theory that focuses on the character traits of an individual, not the individual's behavior

volunteerism—providing services without receiving payment

Women, Infants, and Children (WIC) program—an agency of the U.S. Department of Agriculture serving to safeguard the health of low-income women, infants, and children who are at nutritional risk

work statement—an action plan that explains what, where, and when a program's activities are accomplished

World Health Organization (WHO)—the directing and coordinating authority on international health work; proposes regulations and makes recommendations about global public health practices

χ^2 (chi-square) test—a statistical test that compares proportions when both exposure and outcome are categorical variables

xylitol—a noncariogenic sugar alcohol used as a sugar substitute in food and snack items

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